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ISCA PRESIDENTIAL ADDRESS (2004 TO 2009)

President	Title of Presidential Address*
Prof. Asis Datta 91 st Indian Science Congress 2004, Chandigarh	Science and Society in the Twenty First Century: Quest for Excellence
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Prof. R. Ramamurthi 95 th Indian Science Congress 2008, Visakhapatnam	Knowledge based Society using Environmentally Sustainable Science and Technology
Dr. T. Ramasami 96 th Indian Science Congress 2009, Shillong	Science Education and Attraction of talent for Excellence in Research

* Available in the Book "The Shaping of Indian Science" Published by University Press (India) Pvt. Ltd., 3-5-819 Hyderguda, Hyderabad 500 029.

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**Leishmaniasis: An Overview**

Leishmania is spread over substantial land regions around the world. In India, the sickness shows in two structures: the cutaneous (dry and wet) and the instinctive (kala-azar) assortment. The infection might be sporadic, endemic or pestilence. It has three clinical structures, of which instinctive leishmaniasis (VL) (kala-azar) is the most extreme. Late flare-ups of VL in India and the pestilence of human immunodeficiency infection (HIV) make VL a re-rising issue in India. It likely first showed up in Bihar in 1882 and in Assam in 1869 in the Garo Hill region (by and by in Mizoram). Leishmaniasis parasites grab the inner organs and with no treatment it will prompt passing that is this type of the illness is expressed to be the second biggest parasitic executioner after intestinal sickness.

An extensive number of cases were likewise revealed from Tamil Nadu. Sporadic cases have been accounted for from Gujarat, Jammu and Kashmir and Himachal Pradesh. In the pre-DDT period, there have been very much recorded pestilences of kala-azar in Assam, West Bengal and Bihar; the last real flare-up was accounted for around 1944 from Assam. At display, kala-azar is a difficult issue in Bihar, West Bengal and eastern Uttar Pradesh.

Leishmania is a Group of Trypanosomatid- protozoa and is the parasite in charge of the sickness leishmaniasis. Cutaneous leishmaniasis is the most well-known type of leishmaniasis, in which the parasites have relocated to the indispensable organs. Many anti parasitic plant-derived isoprenoids have been reported, and many of them have good *in vitro* activity against various forms of *Leishmania* species. Numerous anti-parasitic plant-derived natural product such as *Piper aduncum*, *Chinese licorice*, *Maesabalansae*, *Anthemisauriculata*,

Careyaarborea *Liliaceae* have been identified but the molecular target(s) of most of these compounds remain unknown. Effective vaccines against leishmaniasis are still under development. Alternative chemotherapeutic treatment with amphotericin B and its lipid formulations, miltefosine and paromomycin are available but their use is limited either due to toxicity or high cost treatment.

Current chemotherapy of visceral and cutaneous leishmaniasis includes miltefosine, a compound that has been demonstrated to inhibit P13K/Akt signaling pathway, and fluconazole, a sterol 14 α -demethylase inhibitor. In addition to currently targeted *Leishmania* proteins, several other proteins have also been identified, or suggested as potential drug targets in *Leishmania*. Most of these targets include enzymes that are critical to the metabolism of glucose, sterols, nucleotides and glycosyl. phosphatidylinositol, as well as enzymes important for the maintenance of trypanothione and polyamine levels. Many of these proteins have been shown to be important to the survival of the parasites. Other targets include cyclin-dependent- and mitogen-activated protein kinases, topoisomerases and cathepsin-like proteases. Some of the enzymes that are involved in glucose metabolism and are potential drug targets in some species of *Leishmania* include pyruvate kinase (PYK), phosphoglucoseisomerase (PGI), uridinediphosphate-glucose pyrophosphorylase (UGPase), and glyceraldehyde-3-phosphate dehydrogenase (GAPDH), glycerol-3-phosphate dehydrogenase (GPDH), triosephosphateisomerase (TIM), thiol-dependent reductase I (TDR1) and phosphomannomutase (PMM). Most of the current research is being directed towards the

development of newer and more effective drugs against kala-azar. These include amphotericin B, 67-70gold salt," co-trimoxazole with anti tubercular drugs," verapamil," paramomycine," and Gamma-interferon." Clinical trials in India have reported encouraging results with amphotericin B and it has now been recommended by NMEP as a third-line drug." A number of plant extracts have been tried against leishmaniasis with some success in the laboratory" but are of little use clinically.

The complexity and variety of epidemiological settings for foci of leishmaniasis makes it difficult to develop universally adaptable control measures, except for a vaccine.16.78.7P9hase ITI trials with a first-generation vaccine (killed *Leishmania* organism mixed with a low concentration of BCG as

an adjuvant) produced encouraging results." A non-human primate model has been developed to evaluate various vaccines/drugs for leishmaniasis caused by *Leishmaniadonovani*. Preliminary studies using autoclaved *Leishmania major* (ALM) mixed with BCG have been successful in preventing infection with *Leishmania donovani*.

The current challenges in the chemotherapeutic treatments include availability of very few drugs and their toxicity and lack of effectiveness, so therefore it is of utmost importance to look for effective drugs and new targets for the treatment of leishmaniasis.

Some natural compounds such as Flavonoids, chalcones, several quinovic acid glycosides exert *in vitro* anti-leishmanial activity against *L.donovani*.

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

*Perfection is not attainable, but if we chase perfection we can
catch excellence.
- Vince Lombardi*

POWER STATION REMOTE FEEDER MONITORING SYSTEM

Ashok Kumar*, Abhilotsav** and Ankita

Telemetry is the most important component of any communication & monitoring system. With the evolution of smart grid, Internet of things (IOT) & smart cities, telemetry becomes the key factor in their implementation. There is requirement of minimizing communication loss thus transmission channel bandwidth can be effectively utilized. For monitoring grid parameters this is essential as optimization between load & grid frequency has to be maintained. Thus for creating a balance between power generated (in Mw), load (in Mvar) & Grid frequency, an effective telemetry is required so that any fault/load imbalance, Generating & load parameters, Over & Underdrawl of energy can be monitored & recorded at far end control room. Thus role of RTU & FRTU is prominent for implementing SCADA & balancing the power utility system synchronization power generation, power transmission & power distribution. By connecting the main system to the internet, each & every related person can be accessed by a specific password of power system monitoring unit in a particular state/district/Town/Substation / Feeder.

INTRODUCTION

Remote terminal unit¹ (RTU) or Remote telemetry unit or Remote telecontrol unit is a microprocessor-controlled electronic device that interfaces power system components in the physical world to SCADA (supervisory control and data acquisition) system by transmitting telemetry data to a master or control supervisory system. By using messages from the master system, connected power system components can be monitored and controlled. Power Generation unit and High Voltage Power Transmission Control i.e. 765Kv, 400Kv, 220Kv, 132Kv.

It is also deployed in an industrial environment and serves a similar purpose to programmable logic circuits (PLCs) but to a higher degree and extent. An RTU is considered a self-contained unit. Because of this, it can be used as an intelligent controller or master controller for other devices that together automate a process.

FRTU is a feeder level *remote terminal unit* used for SCADA applications in extensively in power system. i.e. 33Kv and 11Kv distribution. It is capable

of monitoring both digital and analog data along with communicating and controlling remote systems. The firmware of FRTU interfaces with the main control centre using various communication protocols² i.e. IEC 101/103/104 etc. FRTU acts as a gateway for various Intelligent Electronic Devices (IEDs). It is a non-proprietary, open architecture system with high in-built security and is designed and developed to work in tropical environment.

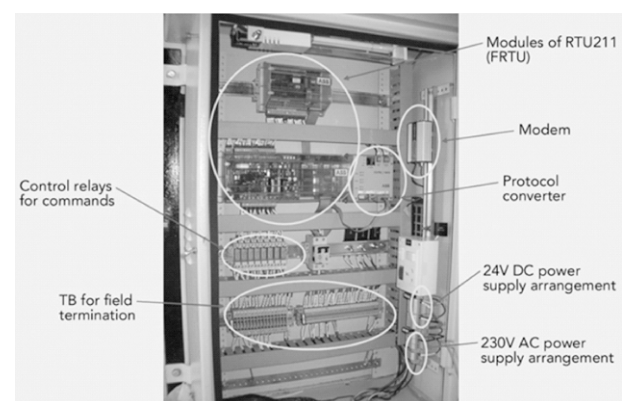


Fig.1. Significant components on a typical remote terminal unit installation¹⁷.

Data Acquisition³ begins at the FRTU / RTU including meter readings and equipment status

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communicated to Control Centre over Networks Links. Typically RTU's having hundreds of Digital Input(DI)/Digital Output(DO) and Analog Input(AI) are deployed in a sub-stations and a fewer DI/DO RTU which are popularly known as FRTU are deployed in Remote Monitoring Units. Sub-stations automation depends on the actual field condition like how large is the sub-station is and how many points or measurands are there to be mapped and database building is required.

SCADA FRAMEWORK AND ROLE

Supervisory control and data acquisition (SCADA)⁵ is a control system architecture that uses computers, networked data communications and graphical user interfaces for high-level process supervisory management, but uses other peripheral devices such as programmable logic controllers ,discrete PID controllers ,RTU/FRTU to interface to the process plant or machinery. The operator interfaces which enable monitoring and the issuing of process commands, such as controller set point changes, are handled through the SCADA supervisory computer system. However, the real-time control logic or controller calculations are performed by networked modules which connect to the field sensors and actuators.

The SCADA concept was developed as a universal means of remote access to a variety of local control modules, which could be from different manufacturers allowing access through standard automation protocols. In practice, large SCADA systems have grown to become very similar to

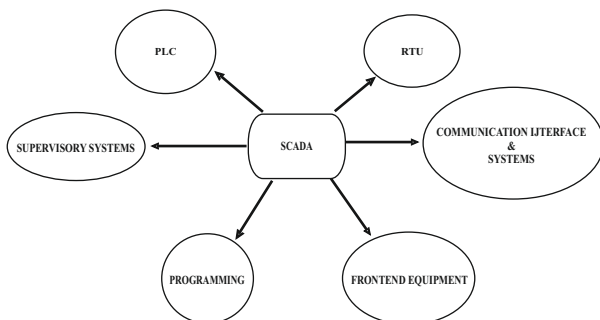


Fig. 2. Depicting SCADA Role in Monitoring⁴.

distributed control systems in function, but using multiple means of interfacing . They can control large-scale processes that can include multiple sites, and work over large distances.

As needs grew to monitor and control more devices , distributed control systems come into play i.e. DCS SCADA which were more intelligent and smaller in size.

SCADA ARCHITECTURE

1. SCADA HARDWARE

A SCADA System consists of a number of RTUs/FRTUs collecting field data and sending that data back to a master station via a communications system. The master station displays the acquired data and also allows the operator to perform remote control tasks.

SCADA hardware⁴ may include following:

1. Field level instrumentation
2. control devices and The master station(s)
3. Marshalling terminals and RTUs
4. Communication Front End Enquiptment(CFE)
5. Lan Switches and DIGI Switches
6. Communications system on OPTICAL /GPRS
7. Data processing department computer system and Programmable Logic Control(PLC)

2 SCADA SOFTWARE

SCADA Software⁴ can be divided into two types, Proprietary or Open. Companies develop proprietary software to communicate to their hardware. These

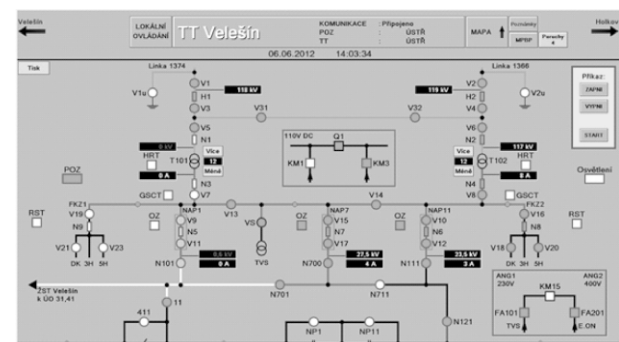


Fig.3.Scada software overview showing Single line Diagram(SLD)of power system components¹⁵ systems are sold as “turn key” solutions.To enable all the nodes on the SCADA network to share

information, they must be connected by some transmission medium. The method of connection is known as the network topology. Nodes need to share this transmission medium in such a way as to allow all nodes access to the medium without disrupting an established sender.

RTU/FRTU FRAMEWORK AND ROLE

The FRTU (*Feeder Remote Terminal Unit*) which is basically advance unit for monitoring remote station wirelessly is an Intelligent Electronic Device (IED) that acquires data from feeders (like RMUs, distribution transformers, etc) and transfers the information to the central monitoring station. The FRTU is a versatile telecontrol device with modular design. The design features flexibility for interchanging the I/O modules. This provides benefit for expansion and easy maintenance. The different communication interfaces available are RS 485, Ethernet, and USB ports for configuration, monitoring and control of tasks. The FRTU features self-supervision functionality and an LED present on the front panel for indication in an event of fault. The FRTU comes with software tools for Configuration and troubleshooting repair.

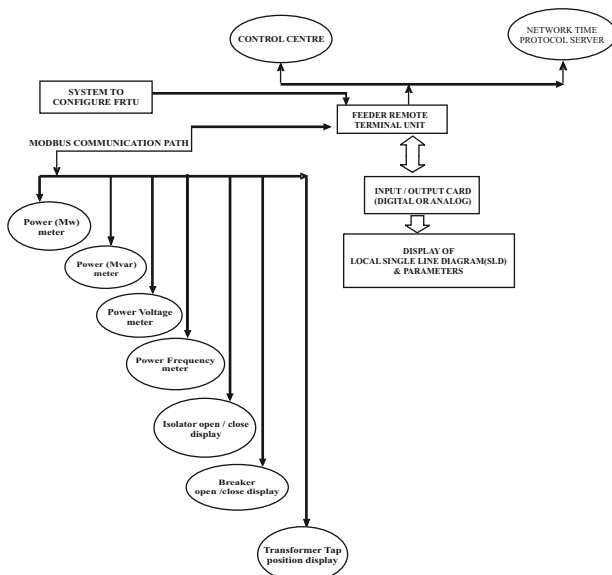


Fig. 4. Showing FRTU Typical Architecture (source internet).

MONITORING AND CONTROLLING FUNCTIONS OF FRTU

1. Acquires analog/digital values⁶ from MFT's, Energy Meters or from IED's.
2. Internal battery backup to hold data in SOE buffer memory.
3. Number of communication ports can be incremented by addition of cards⁶.
4. Supports different communication data exchange rates (bits per second).
5. scanning cycle on each port and different database for each master station.
6. Receive and process digital commands from master stations.
7. Accept polling messages from the master.
8. Acquire data from field inputs.
9. Remote database downloading from FRTU via master station's SCADA/DMS⁶ control centre.
10. LED status indications for various process signals and operating states.
11. Remote monitoring possible due to embedded web application.
12. Supports Simple Network Management Protocol⁶ (SNMP) for alarm management.
13. Acquires parameters from Transducer and status inputs of devices from substations; processes and transmits them to the master stations.

COMMUNICATION PROTOCOL USED IN FRTU

1. IEC (International Electrotechnical Commission):

In electrical engineering and power system automation, the International Electrotechnical Commission⁷ 60870 standards define systems used for telecontrol (supervisory control and data acquisition). Such systems are used for controlling electric power transmission grids and other geographically widespread control systems. It is treated as scheduling, controlling and efficient monitoring in order to optimize power loss and improve availability of power to all at cheaper rate.

By use of standardized protocols, equipment from different suppliers can be made to interoperate. IEC standard 60870 has six parts, defining general information related to the standard, operating conditions, electrical interfaces, performance requirements, and data transmission protocols.

2. MODBUS

Modbus is a serial communications protocol⁸ originally published by Modicon systems (now Schneider Electric) in 1979 for use with its programmable logic controllers (PLCs). Simple and robust, it has since become a *de facto* standard communication protocol and is now a commonly available means of connecting industrial electronic devices. MODBUS Protocol is a messaging structure, widely used to establish master-slave communication between intelligent devices. A MODBUS message sent from a master to a slave contains the address of the slave, the 'command' (e.g. 'read register' or 'write register'), the data, and a check sum. Since Modbus protocol is just a messaging structure, it is independent of the underlying physical layer. It is traditionally implemented using RS232, RS422, or RS485. The function code in the request tells the addressed slave device what kind of action to perform. The data bytes contains any additional information that the slave will need to perform the function. The data field must contain the information telling the slave which register to start at and how many registers to read. The error check field provides a method for the slave to validate the integrity of the message contents.

If the slave¹⁶ makes a normal response, the function code in the response is an echo of the function code in the request. The data bytes contain the data collected by the slave, such as register values or status. If an error occurs, the function code is modified to indicate that the response is an error response, and the data bytes contain a code that describes the error. The error check field allows the master to confirm that the message contents are valid. Controllers can be setup to communicate on standard Modbus networks using either of two transmission modes: ASCII or RTU. When

controllers are setup to communicate on a Modbus network¹⁶ using ASCII (American Standard Code for Information Interchange) mode, each eight-bit byte in a message is sent as two ASCII characters. The main advantage of this mode is that it allows time intervals of up to one second to occur between characters without causing an error. When controllers are setup to communicate on a Modbus network using RTU (Remote Terminal Unit) mode, each eight-bit byte in a message contains two four-bit hexadecimal characters. The main advantage of this mode is that its greater character density allows better data throughput than ASCII for the same baud rate. Each message must be transmitted in a continuous stream.

3. DNP3

DNP3 (Distributed Network Protocol)⁹ is a set of communications protocols used between components in process automation systems. Its main use is in utilities such as electric and water companies. Usage in other industries is not common. It was developed for communications between various types of data acquisition and control equipment. It plays a crucial role in SCADA systems, where it is used by SCADA Master Stations, *Remote Terminal Units* (RTUs), and Intelligent Electronic Devices (IEDs). It is primarily used for communications between a master station and RTUs or IEDs. The Inter-Control Center Communications Protocol (a part of IEC 60870-6), is used for inter-master station communication.

4. RS 485

RS-485, also known as TIA-485(-A), EIA-485, is a standard defining the electrical characteristics of drivers and receivers for use in serial communications¹⁰ systems. Electrical signaling is balanced, and multipoint systems are supported. The standard is jointly published by the Telecommunications Industry Association and Electronic Industries Alliance (TIA/EIA).

5. RJ 45

A Registered Jack (RJ)¹¹ is a standardized telecommunication network interface for connecting

voice and data equipment to a service provided by a local exchange carrier or long distance carrier. Registration interfaces were first defined in the *Universal Service Ordering Code* (USOC) system of the Bell System in the United States for complying with the registration program for customer-supplied telephone equipment mandated by the Federal Communications Commission (FCC) in the 1970s. RJ 45C is a 8P8C keyed one data line with programming resistor surface mount jack.

IMPLEMENTING FTU AUTOMATION

Since power plants are often located far from the population centers, electricity needs to be transmitted across long distances. Power lines deliver electricity from the plant to power substations where it is converted to a lower voltage before being distributed by *feeder terminal units* (FTU)¹² that monitor I/O status by collecting and processing digital and analog data from each site. Due to safety concerns, power grid is divided into several sections categorised into districts. Each district consisted of several neighboring FTUs that are connected in a ring topology and automatically monitored by a *feeder remote terminal unit* (FRTU).

If any of the FTUs is short circuited, the feeder RTU must be able to isolate that particular FTU from the other FTUs thus An IP-based solution is required to enable TCP/IP communications and integration with Self-healing technology required for prompt recovery of monitoring network.

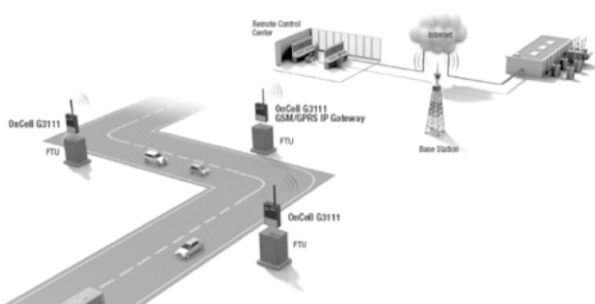


Fig.5. Showing Feeder Terminal Unit using GSM/GPRS IP Gateway(source moxa)¹².

Each FTU is constantly transmitting parameters, such as the fluctuating levels of electricity, to the local feeder RTU for that district. In cases where it is impractical or too costly to use wired connections between the FTUs and feeder RTU, Moxa's OnCell G3111 industrial IP gateway can be installed on an FTU to connect it to the RTU over cellular networks. By taking advantage of the OnCell G3111's ability to connect with a serial interface to GPRS, and Ethernet to GPRS as hybrid connection, Moxa also enabled the utility company to monitor all the districts in the power grid from a remote control center without the inconvenience and expense of constructing a new wired network. As an additional safety precaution, administrators can issue commands to the FRTU to shut down the particular Unit, effectively isolating the problem to protect the rest of the grid. Since electricity is an important service and requires immediate recovery time, the communication link between the FTU and FRTU must be reliable.

In order to provide a functional self-healing network, the OnCell¹³G3111 also comes equipped with GuaranLink, which ensures that the connection will always be ON to provide zero data loss and on-demand cellular communications.

The OnCell G3111/G3151/G3211/G3251 are cellular IP gateways that can conveniently and transparently connect up to two devices to a cellular network. GuaranLink provides uninterrupted cellular communications and improves power reliability by automatically isolating an FTU (when it fails), which shortens the outage time and the scope of damage.

ADVANTAGES OF FRTU IMPLEMENTATION

1. Designed to work in the harsh industrial environment and Light Weight.
2. Easy Transportation and Erection and commissioning.
3. High noise immunity and Low power consumption.
4. Allows the user to upgrade the system from a small configuration to the maximum limit merely by adding suitable input/output modules.

5. Local and remote configuration and Remote database downloading of RTU from master station/SCADA/DMS control centre.
6. Internal battery backup to hold data in *Standard Operating Environment* (SOE) buffer memory.
7. Communication with two master stations simultaneously and can act as a Data Concentrator Unit (DCU)¹⁴.
8. Supports IEC and DNP3 protocols¹⁴ and Acquires data from the IEC and MODBUS Devices.
9. Communication media support¹⁴ Modem (Dial up / Leased line / RF), GSM / GPRS, CDMA, 3G, PLCC, Fiber optic / (*Very Small Aperture Terminal*)VSAT/LAN and GPS time synchronization and standard in-built auto diagnostics.
10. FRTU is configurable using web based configuration and maintenance tool with Possibility to increase the number of communication ports by addition of cards.
11. Supports scanning cycle on each port and a different database for each master station.
12. Can acquire analog values from multi-function transducers, energy meters or from IEDs.
13. Single point and Double point status inputs to read device status.
14. Can acquire Unipolar/Bipolar analog inputs on different signal ranges.
15. Future Power Demand Planning.
16. Power Failure and Power system element Breakdown Analysis along with Alarm history and Event logger history will provide quick access to problem & solution.
17. Managing OverDrawl and UnderDrawl of Power from National Grid by State Power Sector.
18. Managing Underfrequency Drawl at high cost and high loss of energy.

APPLICATIONS

1. Central Grid control Centre can remotely control power elements .
2. Substation Automation and Precise Control .
3. Feeder Automation and Monitoring with Smart IED .
4. Ring Main Unit Automation .

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QUICK METHOD OF TESTING SEED VIABILITY

G. Mani, D.Thirusendura Selvi and M. Madhan Mohan

Seed is an important agricultural input and it plays a vital role in increasing the production and productivity of crops. There is a need to safeguard the farmers with the supply of genetically pure and quality seeds. Any new variety produced by the scientist has to be multiplied many times to meet the needs of the farmers. In order to ensure the availability of quality seeds, it becomes necessary to ascertain the viability (germinability) of crop seeds before sowing. Germination test is the best indication of the potential of a seed lot to emerge under field conditions. However, the germination test requires minimum duration of few days to weeks and in some cases even months to completely ascertain its germinability. Quick viability testing with Tetrazolium salt serves as the quickest method of determining the viability of seeds.

INTRODUCTION

Seeds are uniquely equipped to survive as viable regenerative organisms until the time and place are right for the beginning of a new generation. They cannot retain their viability indefinitely and eventually deteriorate and die. To most of the seed technologists and commercial seedsmen, viability of the seed is its ability to germinate and produce a normal seedling. In another sense, viability denotes the degree to which a seed is alive, metabolically active, and possesses enzyme capable of catalyzing metabolic reactions needed for germination and seedling growth. In this context, a given seed may contain both live and dead tissues, and may or may not be capable of germination. This meaning deals with tissue viability as well as viability of the entire seed. In either context, seed viability is probably highest at the time of physiological maturity, though environmental conditions on the parent plant may not permit germination. After physiological maturity, the viability of seeds gradually declines. Their longevity depends on the environmental conditions to which they are exposed. In India, numerous tests exist for determining the viability of seeds. The germination test of the seed is the most commonly used test to

determine its viability. It has become so universally accepted that seed germination and viability are probably considered one and the same by most people. Regardless of its acceptance, the germination test is merely an estimate and has certain limitations as universal estimate of seed quality. However, if these limitations are recognized, the germination test can be a useful viability index. The relatively long periods of time required for completion of germination tests in various crops delays the seed marketing. This necessitated the development of rapid methods for estimating the germination capacity of seeds and hence the tetrazolium test came into existence. The tetrazolium test is widely recognized as an accurate means of estimating seed viability. This method was developed in Germany in the early 1940's by Professor Georg Lakon who had been trying to distinguish between live and dead seeds by exposing them to selenium salts¹. Then he tried with tetrazolium salts and found them more effective. Today tetrazolium test is used throughout the world as a highly regarded method of estimating seed viability and is a routine test in many seed testing laboratories¹. It is often referred to as a "Quick test", since it can be completed in only a few hours as compared to regular germination tests that require as long as few weeks to months for some species. Tetrazolium test can be extremely valuable for

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providing labeling information for immediate shipment of seed lots without waiting for completion of germination tests. It is also a valuable research technique for estimating seed viability and determining reasons for poor germination¹.

PRINCIPLE

The tetrazolium test distinguishes between viable and dead tissues of the embryo on the basis of their respiration rate in the hydrated state. Although many enzymes are active during respiration, the test utilizes the activity of dehydrogenase enzymes as an index to the respiration rate and seed viability. The highly reduced state of the dehydrogenases enables them give off hydrogen ions to oxidized colourless tetrazolium salt solution, which is changed into red "formazan" as it is reduced by hydrogen ions. Seed viability is interpreted according to the topographical staining pattern of the embryo and the intensity of the colouration¹. Thus tetrazolium test is a biochemical test, in which living cells are made visible by reduction of an indicator dye. The indicator used is 2,3,5 triphenyl tetrazolium chloride (or) 2,3,5 triphenyl tetrazolium bromide. Within the seed tissues, it interferes with the reduction processes of living cells and accepts hydrogen from the hydrogenases. By hydrogenation of the 2,3,5 triphenyl tetrazolium chloride salt, a red stable and non-diffusible substance, i.e., triphenyl formazan is produced in the living cells of seeds³. The chemical reaction that changes the colourless tetrazolium solution into formazan is picturized in Fig 1.

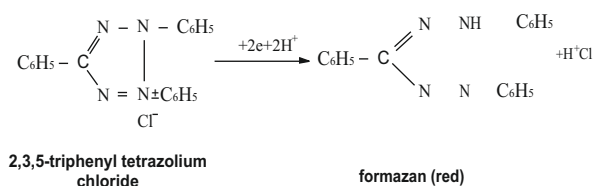


Fig.1. The chemical reaction that changes the colourless tetrazolium solution into formazan.

This makes it possible to distinguish between the red coloured living parts of seeds from the colourless dead ones. Staining of seeds determines whether the seeds are to be classified as viable or non-viable. The completely stained seeds are considered as viable

ones whereas the partially and completely unstained seeds are classified as non-viable ones. In addition to completely stained viable and completely unstained non-viable seeds, partly stained seeds may also occur. The portion and the size of the necrotic areas in the embryo or endosperm determine whether such seeds are viable or non-viable. Since it provides a topography of living and dead tissues, it is called as "topographical tetrazolium test"³.

FIELD OF APPLICATION

In general, Tetrazolium test is not valid for the previously germinated seeds (already germinated seeds).

METHOD OF TERTRAZOLUM TESTING

- A. Testing Sample:** The test sample shall be carried out with four replicates of each 100 seeds drawn at random from the pure seed fraction of purity test².
- B. Preparation of Solutions:** An aqueous solution of 0.1 to 1.0% triphenyl tetrazolium chloride or bromide of neutral pH is used. 1% of the tetrazolium solution is usually used for the seeds that are not bisected through the embryo, whereas 0.1% solution is used for seeds in which the embryo is to be bisected.

The pH of the solution should be between 6 and 8 for the best staining to occur. If the pH of the water is not in the neutral range (6.5-7.0), the Tetrazolium salt should be dissolved in a phosphate buffer solution. The buffer solution is prepared as follows:

Solution 1: Dissolve 9.078 g of KH_2PO_4 in 1000 ml of water

Solution 2: Dissolve 11.876 g of $\text{Na}_2\text{HPO}_4 \cdot 2\text{H}_2\text{O}$ in 100 ml of water

Take 400 ml of solution 1 and 600 ml of solution 2 and mix them together. In a litre of buffer solution prepared as above, dissolve 10 gms of Tetrazolium salt. This gives 1% Tetrazolium solution of PH 7.0. This may be further diluted to give lower concentrations.

The solution should be stored in brown bottle to prevent deterioration from light².

PREPARATION OF SEEDS FOR STAINING

The seeds are first prepared for staining, then stained and further evaluated for viability².

METHOD-1 : BISECT LONGITUDINALLY

For crops like Maize, Sorghum and large seeded grasses, etc. this method is used. The seeds are pre-conditioned by soaking in water for 3-4 hours or by keeping the seeds in moist blotter paper over night, then the seeds are bisected longitudinally to expose the main structures of embryo. Normally, only one section of each seed (one ½ of each seed) is used for testing and drying is avoided².

METHOD-2: BISECT Laterally

Example: Small seeded grasses

In these crops, seeds are cut laterally near the centre of the seed above the embryo and the embryo end is placed in Tetrazolium solution².

METHOD-3 : PUNCTURE WITH NEEDLE

Example: Small seeded grasses (small endospermic seeds)

In these crop seeds, the seeds are punctured by piercing through the seed into the endosperm near the embryo, but the injury to the embryo should be avoided².

METHOD-4 : SEED COAT REMOVAL

All dicotyledons with the seed coat impermeable to solution

Example: Bendi, Gourds, Cotton etc., In such seeds, after their pre-conditioning, the coat is removed. In these crop seeds, the seeds are soaked in water for 3-4 hours and then seed coats are removed and seeds are placed in the tetrazolium solution. In some crops like cotton, a thin membrane adhering to the cotyledons is also removed in addition to the seed coat².

METHOD-5: CONDITIONING ONLY

Example: Large seeded legumes

The seeds of soyabean and other large seeded legumes may swell so rapidly and irregularly when placed directly in water or in tetrazolium solution so that the seed coats burst. Hence it is preferable to pre-condition these seeds slowly in moist paper

towels overnight before staining so that they are allowed to absorb moisture slowly without any damage to the seed².

METHOD-6: NO CONDITIONING OR PREPARATION

(eg) Small seeded legumes

In these seeds, the seed coats are permeable to Tetrazolium and the embryos usually will stain without conditioning².

METHOD-7: EXCISED EMBRYO

Where the embryo is sufficiently large it can be excised for treatment in Tetrazolium solution as in case of the Oil Palm².

STAINING

The prepared seeds should be placed in suitable container (small beakers, petri-dishes etc) and covered with tetrazolium (TZ) solution and then the containers are placed in an incubator at dark, warm conditions of 40°C.

The staining time varies for different kinds of seeds, different methods of preparation and different temperatures (<1 hr to 8 hrs). Hence, the period required for staining vary depending on the concentration of the solution, atmospheric temperature and nature of the seed.

When the sample has stained sufficiently, the Tetrazolium solution should be discarded and the seed sample covered with water immediately. Seed samples can also be kept for 3 days at 10° C for interpretation².

METHOD OF PREPARATION AND DURATION AT DIFFERENT TEMPERATURE FOR STAINING

S. No	Name of the seed	Preparation conditions	Staining time	
			30°C	40°C
1.	Maize, Wheat, Sorghum, Millets of large seededness	Soaking in water for 4 hrs. Bisect in to 2 longitudinally.	2 to 6 hrs.	1 ½- 4 hrs.
2.	Rice	Soaking in water for 4 hours. Bisect longitudinally or removal of glumes.	3 to 6 hrs.	2 to 4 hrs.

S. No	Name of the seed	Preparation conditions	Staining time	
			30°C	40°C
3.	Small seeded grasses and millets	Place the seeds in -between moisture media for 4 to 6 hrs. Bisect near embryo.	2 to 6 hrs.	1 1/2-4 hrs.
4.	Cotton	Soak in water for 4 hrs. Remove the seed coat and inner membrane (impermeable).	2 to 6 hrs.	1 1/2-4 hrs.
5.	Small seeded legumes like Green gram, Black gram and Cowpea	Soak in water for 4 to 5 hrs and remove the seed coat.	4 hrs	1 1/2-3 hrs.
6.	Large seeded legumes	Soak in water for 4 to 5 hrs. Removal of seed coat.	3 to 6 hrs.	2-4 hrs.
7.	Groundnut	Soak in water for 4-6 hrs. Removal of seed coat, one cotyledon may be separated.	4 to 7 hrs.	3-6 hrs.
8.	Gingelly, Sunflower	Soak for 4-6 hrs. Remove seed coat.	4 to 6 hrs.	3-6 hrs.

EVALUATION OF SAMPLES

The tetrazolium test is often called as the "topographical tetrazolium test" because the pattern or topography of staining is an important aspect of its interpretation. Many seeds are neither completely dead nor completely alive. The staining pattern reveals the live and dead areas of the embryo and enables the analyst to determine if the seeds really have the capacity to produce normal seedlings. The cell division areas of the embryo are most critical during germination, and if they are unstained, or abnormally stained, a seed's germination potential is weakened. The analyst must be familiar with crucial cell division areas of the embryo and learn to interpret their staining pattern in terms of seed germinability. After staining, washing and any other preparation required for cleaning the seed or bisected seed or embryo, the intensity and location of stain are evaluated under a low power binocular microscope

or magnifying lens. The seeds would broadly fall into three groups :

- (i) Completely stained (viable seed)
- (ii) Completely unstained (non-viable seed); and
- (iii) Partially stained, the classification of which as either viable or non-viable would require further test.

Stain intensity is important as viability index. Viable tissues should stain as bright red (sometimes described as carmine red). Pink and very dark red stains may appear as artifact on dead tissue as found in some dicot seeds where differential staining is often observed on the surface of the cotyledons. However, viable seed embryos will be stained as very dark red colour if the staining period is too long.

TISSUE CHARACTERISTICS

(i) Sound tissues: Staining proceeds gradually and uniformly from the exposed surfaces inward. Changes in the intensity of colour are gradual without distinct boundaries. The colour intensity is lesser but lustrous in sound tissues than the bruised, damaged or aged tissues. A gradual reduction in colour intensity from the surface to the interior of the seed indicates slow absorption and firm, sound and unstained tissues indicate the lack of penetration of the tetrazolium solution⁴.

(ii) Weak viable tissues: Such tissues tend to stain greyish red to brighter red than normal. The apical tips of leaves, coleoptiles and radicles tend to reveal earlier evidence of deterioration than do other areas. Weak and aged tissues also lose the turgidity of the sound tissues, they appear flaccid and develop mottled stain⁴.

(iii) Weak non-viable tissues: Tissue colour is often mottled, it may be purplish, brown or greyish red and its intensity may vary from abnormal dark to pale pink. Cut surfaces may appear off white, while the inner tissues may appear dark red. The unstained dead tissues look flaccid, liquid-logged, blurred, chalky white and lack lusture.

A definite boundary does not necessarily occur between the non-viable, abnormally stained, stained and unstained tissues. Both types of tissues are

therefore considered dead, regardless of colour differences.

Seed structure and the seed as a whole must be considered while evaluating staining pattern. Seed may be considered non-germinable even when there is only one fracture or one small broken or missing spot in a vital position such as the point of attachment of roots and cotyledons. Seed is considered dead when unstained areas include mesocotyl and seminal roots in grasses and tips of coleorhiza in wheat and rye. The areas of vital importance in interpreting the staining pattern in monocot are the plumule tips, the portion where the embryo is attached to the scutellum and seminal root region. In legumes, injuries caused to the growing organs must be noted carefully so that the injuries of the other organs. Unstained radicle tips in legumes may not allow the radicle to grow. Improper staining in areas such as radicle and hypocotyle development, cotyledons and in the plumule region indicate a non-germinable or abnormal seed.

The tetrazolium percentage is the percentage of normal germinable seeds to be expected when the seed lot is germinated under very favourable conditions. Properly conducted tetrazolium and germination test results are generally very close⁴.

MONOCOTS

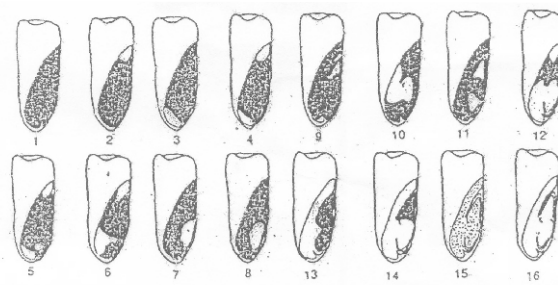
NON-VIABLE

1. All structures unstained.
2. Shoot largely unstained.
3. Scutellar node unstained.
4. Major areas of coleoptile unstained.
5. Central area of scutellum unstained.
6. Insect, mechanical or other injuries causing essential structures non-functional¹.

DICOT SEEDS

NON-VIABLE

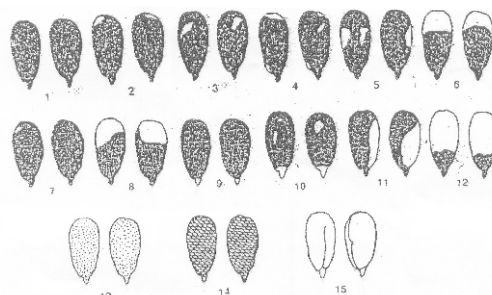
1. Embryo completely unstained.
2. More than extreme tip of radicle unstained.
3. More than 1/2 of cotyledon tissue unstained.
4. Deep – seated necrosis at cotyledon and embryonic axis juncture or on radicle.
5. Fractured radicle².



Criteria for interpretation of tetrazolium test results

- ⊕ Black areas indicate stained and living tissue
 - ⊕ White areas represent unstained and dead tissue
- 1 : Germinable – entire embryo stained bright red
 - 2-4 : Germinable – extremities of scutellum unstained
 - 5-6 : Germinable – extremities of scutellum unstained; non-critical portions of radicle unstained
 - 7-8 : Non-germinable – area where seminal roots originate is unstained
 - 9 : Non-germinable- plumule unstained
 - 10 : Non-germinable – central portion of scutellum and area of seminal roots development unstained
 - 11 : Non-germinable – plumule and radicle unstained
 - 12 : Non-germinable – unstained area on lower scutellum and radicle extends into region where seminal roots develop
 - 13 : Non-germinable, scutellum entirely unstained
 - 14 : Non-germinable – scutellum and radicle unstained
 - 15 : Non-germinable – stain very faint pink
 - 16 : Non-germinable – entire embryo unstained

Fig. 2. Picturises the tetrazolium staining pattern in Maize seeds.



Criteria for interpretation of tetrazolium test results

- ⊕ Illustrations are paired and depict both sides of seed. Black areas indicate stained, living tissue
 - ⊕ White areas represent unstained and dead tissue
- 1 : Germinable – Seed completely stained; stain not overly intense
 - 2-5 : Germinable – minor unstained areas on cotyledons
 - 6 : Germinable – less than one third of cotyledons unstained
 - 7 : Germinable –extreme tip of radicle unstained; minor unstained spots on cotyledons
 - 8 : Non-germinable- more than one-third of cotyledons unstained; extreme tip of radicle unstained
 - 9-10 : Non-germinable – more than extreme tip of radicle unstained
 - 11 : Non-germinable – unstained area on cotyledons extends into region where radicle and cotyledons are attached
 - 12 : Non-germinable – more than one third of cotyledonary tissue unstained
 - 13 : Non-germinable – seed stained , grayish red, cloudy or milky red colour; cotyledons not expanded; seed relatively smaller than germinal seed
 - 14 : Non-germinable – seed stained abnormally dark; purplish red cotyledons not expanded; seed relatively smaller than germinable seed
 - 15 : Non-germinable – seed completely unstained

Fig. 3. Picturises the tetrazolium staining pattern in Cotton seeds.

ADVANTAGES OF TETRAZOLIUM TEST

1. Quick estimation of viability of seeds is possible.
2. Even in the dormant seeds we can find the viability potential of the seeds.
3. In dicot seeds, the seeds are not damaged in analysis (tetrazolium test), therefore they could be used for further germination in the field also².

DISADVANTAGES OF TETRAZOLIUM TEST

1. It is difficult to distinguish between the normal and abnormal seedlings.
2. Tetrazolium test does not differentiate the seeds that are dormant and non-dormant.
3. Since the tetrazolium test does not involve the germination of seeds, micro-organisms harmful to germinating seedlings are not detected².

CONCLUSION

Seeds are the protectors and propagators of their kind. Thus a farmer's crop depends on the quality of the seed he uses for sowing or planting. If the seed has poor germination, the farmer will have a poor stand which would ultimately result in poor yield of the crop. Viability of seed represents the capacity of the seed to germinate or, in other words, seed viability is defined as its capacity to remain capable

of germination for some specific period of time. In the Indian seed programme, a very large quantity of seed is usually procured in the shortest possible time, where it becomes a necessary to decide within 24 hours time whether or not a particular seed lot is to be purchased. Seed tests for germination form the most reliable and satisfactory basis for choosing or not a lot but the method is very slow which necessitates a rapid test to find out whether the seeds are viable under favourable conditions they may germinate or not. Topographical tetrazolium test is one such test wherein the viability of seed is determined for most of the crops. Based on the staining pattern and the intensity of staining, the seeds are classified as viable or non-viable.

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MUH NUCHAWA: THE GIANT WATER BUG

Sushil Kumar Upadhyay

Giant water bugs are commonly found in ponds and slowly moving fresh waters. It normally feeds on other pond organisms such as aquatic insects, crustaceans, molluscs, small fish and tadpoles. Adult insects do not breathe under water, therefore, returns to the surface to breathe through the two short respiratory tubes at the tip of the abdomen. Swimming is accomplished by means of flattened hindlegs that are modified for this purpose and resembles oars such legs are called "natatorial legs". The powerful forelegs are tipped with a curved hook shaped claw and are used to grasp and hold prey, then inject a poison fluid in the prey by piercing and sucking type of mouth parts. They are frequently attracted towards light at night hence one of their common name "Electric light bug". The bugs are also called "Toe biter" as they have been known to deliver a painful bite to the odd lower appendages when carelessly handled. During the period of drought (Year 2003) in the Avadh area of Eastern Uttar Pradesh these bugs were recognized as dangerous creation named "Muh Nuchawa".

INTRODUCTION

TAXONOMIC SUMMARY

The giant water bugs are belongs to subfamily Belostomatinae; family Belostomatidae; superfamily Nepoidea; suborder Heteroptera; order Hemiptera; division Exopterygota; subclass Pterygota; class Insecta and phylum Arthropoda. There are about 150 species of giant water bugs, worldwide in distribution. Common fresh water giant water bugs found in the Avadh area of eastern Uttar Pradesh, India belongs to genus *Belostoma*, *Lethocerus* and *Abedus*.

HABITAND HABITAT

The habitat of giant water bug in India includes ponds, lakes and slow moving rivers and streams. It is carnivorous in nature and normally feeds on the pond organisms: aquatic insects, mollusks, crustaceans, small fish and tadpoles. The giant water bugs generally do not harm to crops, pets and human beings. Usually they reproduce in the water bodies. Adult giant water bugs are often encountered by people when they move away from their natural habitat perhaps in search of other water bodies to colonize are in search of mate. Generally they fly at

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night and orient their flight with respect to moon and stars. With advent of electric light the bugs lost their orientation during flight and were governed by the electric light sources, while navigating they move rapidly and spirally towards the light aimlessly, becoming exhausted they fall on the ground¹.

In drought conditions or scarcity of aquatic habitat these bugs move out of the water bodies towards the human habitation. They encounter people and inflict wound unknowingly on the open parts (face and limbs) of the body. During the period of rigorous drought (year 2003) in the Avadh area of eastern Uttar Pradesh these bugs were recognized as a dangerous creation named as "Muh Nuchawa". This was a matter of local gossip and even it appeared as a news items in the media (News papers and T.V. channels).

SHAPE, SIZE AND COLOR

Giant water bugs are large in size i.e., 1-2 inches in length with the largest being upto 150 mm (6 inches). These insects are generally flat, wide, boat shaped (*Lethocerus*), somewhat rounded or oval (*Belostoma* and *Abedus*), with a pair of short respiratory tube at the tip of abdomen. Body is covered by leathery brownish or chocolaty brown

exoskeleton in *Lethocerus* and *Belostoma* while blackish brown to yellowish-tan in *Abedus*. They are provided by paddle shaped hind legs (Natatorial legs) equipped for active swimming.

BIOLOGY AND PATERNAL INVESTMENT STRATEGIES

In late spring or early summer (March) the adult bugs mate and female glues her eggs on the stems of emergent vegetation or other structures just above the water's surface. About 95% of insect species belonging to subfamily: Belostomatinae exhibit postzygotic paternal care². The males remain nearby to protect them and to keep them moist by periodically crawling out of the water and over top of the eggs. The male brood eggs oviposited as a cohesive unit (egg pad) upon their back by the female³. In *B. flumineum* the eggs are deposited on the male's back but it has been observed that they discard the egg pads before hatching. In *A. herberti* the female repeatedly approaches the passive male and then the male performs courtship displays and brood the eggs masses on its back. In another species *L. medius* the males do not brood eggs on their back.



Fig. 1. Ventral and dorsal view of *Lethocerus medius*.

They attended egg clutches and defend them against predators until hatching². The operational sex ratio may be come female biased during early summer which shows egg destroying behavior in female

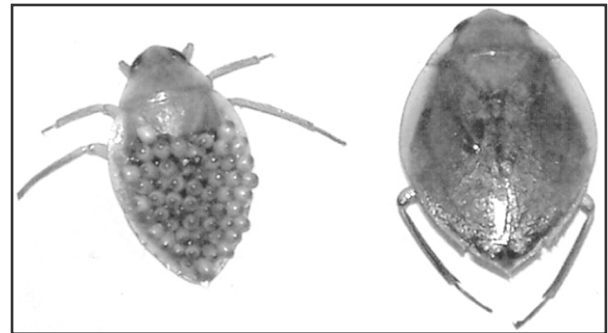


Fig.2. Male *Abedus herberti* carrying egg pad on its back and a female without eggs.

*L. medius*⁴. The young are called naids (aquatic nymphs) and hatch in about two weeks. The nymph resembles the adult and go through five developmental stages (instars) shedding their skin to move from one stage to the next. This is known as "simple metamorphosis". Adult water bugs overwinter in water bodies⁵. Head is small bearing one pair antennae of 4 to 5 segments, one pair of compound eyes and ocelli. Mouth parts are elongated in to piercing and sucking beak with a sheath like labium stylets are grooved, slide up and down during feeding. Pronotum of the thorax is large and metathorax forms a triangular scutellum.

HUNTING BEHAVIOR

The giant water bugs and their nymphs are ferocious predators usually hunting by "lying-in-ambush" grasping a submerged weed. Any motion of the prey may induce a rapid "lunge and grab" with its hook tipped forelegs. The bug injects toxic enzymes into the prey by its needle like rostrum which digests the tissues. Now the bugs suck out the predigested tissue fluid.

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DECLINING CHILD SEX RATIOS IN INDIA – A MATTER OF CONCERN

T. Chandrasekarayya

Declining Child Sex Ratio causes imbalances in child population and expected to have serious socio-demographic consequences, further reinforcing the subordination of girls and women. The issue, therefore, requires a multi-faceted response to enhance the value of girls by change in negative perceptions on girl child as well as legal measures to curb misuse of medical technology.

INTRODUCTION

The Child Sex Ratio (number of female children per 1000 male children in the age group of 0-6 years) attempts to bring out the recent changes in our society in its attitudes and outlook towards the girl child. A balanced Child Sex Ratio (CSR) is necessary for smooth continuation of any society, while, an imbalance in child sex ratio leads to severe socio-economic, demographic and cultural consequences in the society. The declining juvenile sex ratio is indicative of marginalization of girl children. In India to honor the girl children, every year “January 24” is observed as the “National Girl Child day”. Unfortunately, the girl child is having most burdens in Indian society-looking after younger sibling, doing household chores, and neglected in many ways than boys in several parts of India, especially in downtrodden sections. The sharp decline in child sex ratio is a severe problem in many parts of country since 1950. It is quietly witnessed in 2011 census as well. This steep decline in child sex ratio is dangerous sign of the girl child deficit. Further, it has shown an alarming signs of gender inequality in child population.

HIGHLIGHTS OF 2011 CENSUS

The rapid decrease in child sex ratio that came as a shocker in the latest census figures shows 914 girls, and this is the lowest ever since Independence, slipping from 927 in 2001. The increasing trend has been seen in Punjab, Haryana, Himachal Pradesh,

Gujarat, Tamil Nadu, Mizoram, and the Andaman and Nicobar Islands, while in all, the remaining 27 states and Union Territories, the rate has shown a decline. It was the highest in Mizoram at 971, closely followed by Meghalaya (970), while at the rock bottom was Haryana with 800 and Punjab with 846. At the district level, Lahul and Spiti in Himachal Pradesh had the highest child sex ratio at 1,013, while in Twang district of Arunachal Pradesh, it was 1,005. It was shamefully low in Jhajjar and Mahendragarh of Haryana at 774 and 778 respectively.

TRENDS OF CHILD SEX RATIO

The child sex ratio is a sensitive indicator that displays the status of girl child. The study of trends in Child Sex Ratio (CSR) will reveal the intensity of changes in it, over a period of time. Here, Overall Sex Ratios (OSR) of India are taken to know the gravity change in sex ratios. The child sex ratio has been declining faster than over all sex ratio. The Child ratio was 983 in 1951, declined to 976 in 1961, 964 in 1971, and 962 in 1981. It further dropped to 945 in 1991, 927 in 2001 and came down to 914 in 2011, while, the corresponding figures for overall sex ratios were 946, 941, 930, 934, 927, 933 and 940 respectively. Thus, in recent decades, the child sex ratio has drastically declined. It recorded highest fall, dropping 18 points from 945 to 927. Moreover, in 2011, the child sex ratio (914) was lower than overall sex ratio (940), which reveals the severity of the problem.

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CHILD SEX RATIO BY RESIDENCE

It is one of the important indicators of health status and equity between sexes in society. With better technology being available for selective sex abortions, India's case of 'missing girls' is far more glaring in urban India than in rural areas. The child-sex ratio, which is otherwise an issue throughout the country, is even lower in urban areas than rural areas.

Table-1: Child Sex Ratio (CSR) of India by Residence.

Child Sex ratio By Residence	Census Year					
	1961	1971	1981	1991	2001	2011
Total	976	964	962	945	927	914
Rural	957	968	963	948	934	919
Urban	951	948	959	935	906	902
Rural-Urban Gap	6	20	4	13	28	17

Source: Census of India, 2011.

Table-1 shows that in 1961 census, the child sex ratio at the National was 976; whereas the rural child sex ratio stands at 957 and urban child sex ratio was 951. The corresponding figures in 2011 census are 914, 919 and 902 respectively. Further, the gap in rural-urban child sex ratio was 6 points in 1961, rose to 17 in 2011.

BOTTOM TEN STATES/UTS

The child sex ratio is generally affected by two factors namely mortality differentials under 6 years and extent of medical interferences, which influence overall sex ratio of an area or country. Data on ten bottom states/U.Ts with child sex ratio reveals enormity of problem at macro level, which is useful for sub-planners to deal with the issue.

Table-2 shows that in 2001 census, among the ten worst child sex ratio states, two economically progressed states namely Punjab and Haryana, ranks first and second respectively followed by Chandigarh and Delhi. The other six states were Gujarat, Himachal Pradesh, Uttaranchal, Rajasthan, Maharashtra and Uttar Pradesh. While in 2011 census, Haryana and Punjab are the worst with least CSR followed by Jammu and Kashmir, Rajasthan, Maharashtra, Uttaranchal, Gujarat, and Uttar Pradesh in bottom ten states. The other two are

Uts, Delhi and Chandigarh.

Table-2: Bottom ten States/U.Ts according to Child Sex Ratio, 2001 & 2011.

S. No	Census Year, 2001		S. No	Census Year, 2011	
	State	CSR		State	CSR
1	Punjab	798	1	Haryana	830
2	Haryana	819	2	Punjab	846
3	Chandigarh	845	3	Jammu & Kashmir	859
4	Delhi	868	4	Delhi	867
5	Gujarat	883	5	Rajasthan,	882
6	Himachal Pradesh	896	6	Maharashtra	883
7	Uttaranchal	908	7	Uttaranchal	885
8	Rajasthan	909	8	Gujarat	886
9	Maharashtra	913	9	Chandigarh	887
10	Uttar Pradesh	916	10	Uttar Pradesh	889

Source: Census of India, 2001 & 2011.

BOTTOM TEN DISTRICTS

It is one of the important indicators of health status and equity between sexes in society. Data on the districts which recorded lowest child sex ratio highlights the pattern of spatial disparities.

Table-3: Bottom ten districts by Child Sex Ratio India, 2001&2011.

Sl. No	Censuses Year, 2001			Censuses Year, 2011		
	District	State	CSR	District	State	CSR
1	Fatehgarh Sahib	Punjab	766	Jhajjar	Haryana	774
2	Patiala	Punjab	777	Mahendragarh	Haryana	778
3	Manasa	Punjab	782	Rewari	Haryana	784
4	Bathinda	Punjab	785	Samba	Jammu & Kashmir	787
5	Kapurthala	Punjab	785	Sonipat	Haryana	790
6	Sangur	Punjab	786	Jammu	Haryana	794
7	Gurudaspur	Punjab	789	Bid	Maharashtra	800
8	Kurukshetra	Haryana	771	Ambala	Haryana	806
9	Ambala	Haryana	782	Rohtak	Haryana	807
10	Sonipat	Haryana	788	Pithoragarh	Uttarakhand	812

Source: Censuses of India, 2001&2011.

Table-3 shows that the "Top of the Pops", known as, the districts with the worst child sex ratio were, all in Punjab and Haryana, ironically in two of India's

wealthiest States in 2001; The worst of these ten was in Fatehgarh Sahib in Punjab with a child sex ratio of just 766. All the districts of two states are covered in the range of 766 to 788. The other eight districts were Kurukshetra and Ambala in Haryana and Patiala, Mansa, Kapurthala, Bhatinda, Gurudaspur and Sangrur in Punjab. While in 2011, four states viz Haryana, Jammu & Kashmir, Maharashtra and Uttarakhand come under this category. The bottom ten districts with lowest child sex ratio are Jhajjar, Mahendragarh, Rewari, Ambala, Rohtak in Haryana, Samba in Jammu & Kashmir, Bid in Maharashtra and Pithoragarh in Uttarakhand. These Tables show a heavy loss of female child, cautioning the status of girl child in two states.

CAUSES FOR DECLINING CHILD SEX RATIO

Sex Selective Abortions: Between 1980 and 2010, it was estimated that 4 to 12 million girls were aborted because of their sex. It is estimated that illegal gender-selective abortions number 500,000 annually in India¹. Thus, access to ultrasound is fairly widespread, which causes to prenatal sex determination through Ultrasound technique, followed by induced abortion of female foetuses⁶.

Sex Ratio at Birth: Worldwide, the normal Sex Ratio at Birth (SRB) is about 105 male babies per 100 female babies. However, India measures the SRB in reverse of the usual standard, i.e. female births per 1,000 male births, making 950 a normal SRB in India. It is declining due to sex selective pre-birth interventions².

Infanticide, Abuse and Neglect of Girl Children: A sex ratio less than the normal range of 943-980 girls per 1,000 boys, suggests discrimination against girls, and the presence of female infanticide, which is the killing of girls after birth, or of female foeticide, sex-selective abortion of the foetus⁴.

Missing Girl Children: Anirudha Dutta in his article cited the estimations of renowned Economist Amartya Sen that 41.6 million girls had vanished in India in 1990¹.

Son Preference: In agrarian societies, sons are desirable as hands to work the field, and small towns value sons as an asset in the fight against the "encroaching urban society"⁸. In addition, many couples depend on a son to care for them in their old age and assist in the financial stability of the family⁹.

Sex Differentials in Child Mortality (0-6 Years): In the country as a whole, female child mortality is 40 percent higher than male child mortality. The sex differentials in infant and child mortality suggest that there is strong son preference and discrimination against female children³.

Under Reporting of Females: In general, in some parts of country females are discriminated with socio-cultural and considered as secondary citizens, their status is lower than males, it causing to under reporting of females at the time of population enumerations^{3,7}.

Son Preference and Male Bias: Old cultural views and traditions are still strong in many parts of the country, where a girl means both a financial imposition on the family (in terms of a dowry), and the loss of a family heir. In addition, many couples depend on a son to care for them in their old age and assist in the financial stability of the family⁹.

CONSEQUENCES

In the long run, the girl would be more in demand than boys. The girl could insist that the boy's family incur the cost of wedding.

There would also be more inter-caste, inter region and inter-religion marriages which again would be creating many socio-cultural and other problems.

The age gap between bride and bridegroom may increase.

Some boys remain unmarried due shortage of girls in their caste/clan

The boys of one region, where the gender ratio is more skewed will marry other region girls; the choice rest with the girls.

POLICY AND ADVOCACY MEASURES

Perception change among the public on values of daughters as equal to sons.

Explaining severe consequences of girl child deficit

Old Security for poorer sections

Strict execution of Pre-Natal Determination Test (PNDT) Act

Provision for better education for Girl Children

Involving religious leaders for describing the value of girl child, because they can influence many aspects of public including population matters.

Performing some religious rituals by girls

Discrimination against girl should be avoided by parents

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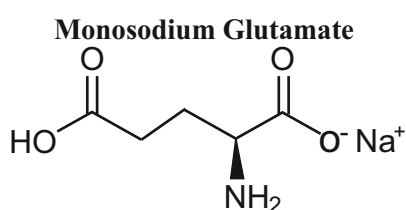
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ECONOMIC PERSPECTIVE OF MONOSODIUM GLUTAMATE LIES FAR BEYOND ITS IFS & BUTS

Parveen Sachdeva

A simple internet search reflects with numerous advocates and opponents on both sides of MSG for being its use as a flavor enhancer causing various health problems. Review data from the world's top scientific sources revealed MSG as safe for human consumption and so as the international and national bodies governing food additives. Under Indian Food laws, MSG is a permitted additive in foods and labels to indicate its presence is a condition. In prevention of food adulteration rules 1955, it is stated that MSG may be added to a food article, provided the glutamate content of the ready-to-serve food does not exceed 1 percent. It shall not be added to any food meant for infants below 12 months. Many studies from time to time reported adverse side effects of MSG consumption and most of the counter checks always supported MSG for not being the real cause. A few recent studies reported adverse specific health impacts of MSG consumption viz. a study reported high doses of MSG is associated with increased risk of obesity and metabolic syndrome; a study on rats reported its adverse effects on kidney functions; and a few research papers tell the excessive consumption of glutamate promotes cancer growth. Studies also came out with suspected health benefits through MSG intake in addition to its taste enhancing properties viz. about its role in digestion, its probability as an energy source for developing gut in infants, probable role in improving hemoglobin levels, its partial replacement with sodium in table salt may reduce blood pressure problems, its replacement with phosphates in automatic dish washing detergents will help in many ways, etc. This review focuses on the history and origin of MSG; its commercial production; its basics in food chain; its applications as a food additive; its contribution to health; its controversial aspects; outcomes of counterchecks; and about its other probable uses. Article also focuses on huge economic potential through MSG Production & Trade and about the emerging manufacturing base in India.

INTRODUCTION



(IUPAC name: Sodium 2-aminopentanedioate)

Kikunae Ikeda isolated glutamate from kombu seaweed (kelp), and added sodium to create monosodium glutamate.

He propounded the taste different from sweet, sour, bitter and salty and named this distinctive fifth taste as 'umami'.

Food Additive Monosodium Glutamate "MSG" is called by its trade name "ajinomoto". The literal translation of 'Aji no Moto' is 'Essence of Taste'

Researchers revealed, MSG is simply comprised of water, sodium and glutamate and is the most common non-essential amino acid that can be easily metabolized by human body. Glutamic acid is one of the two amino acids (the other being aspartic acid) or its ionic forms 'Glutamate' and 'Glutamine' are under-rated as "good" dietary amino acids found in most high protein foods. Human body itself generates free glutamate for use as a component of metabolism or as a component of many proteins and peptides of most tissues serving as the building blocks of life.

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The substances, which constitute the umami taste, can be divided in two main groups: one is the amino acid group, represented by monosodium glutamate and the other is 5'-nucleotid group, represented by inosine 5'-monophosphate (IMP) and guanosine monophosphate (GMP) and their derivatives.

MSG has no texture or smell of its own, and therefore it serves to emphasize the natural flavor of food itself, rather than adding an independent flavor.

By adding MSG in food appropriately, sodium chloride addition could be reduced by 30-40% while maintaining the same perception of saltiness.

Glutamate only functions as an enhancer of taste when it is in free form and not when it is bound with other amino acids.

MSG is not palatable to sensitive individuals.

The ancient Romans used garum 'similar to fish souce, rich in glutamate' as a condiment to season their dishes⁴. A German chemist 'Karl Heinrich Ritthausen' discovered glutamic acid in 1866, when he treated wheat gluten with sulfuric acid⁶. In 1908, A Professor from the University of Tokyo in Japan 'Kikunae Ikeda' isolated 'monosodium glutamate' or in short 'MSG' from broth of seaweed 'kombu' by aqueous extraction and crystallization, that looked similar to table salt or sugar, which is having ideal storage properties^{7,13}. He found it as the sodium salt of glutamic acid having a long lasting taste with mouth watering and sensation over tongue⁸. He further described when the protein containing glutamic acid is broke down by cooking, fermentation or ripening, it becomes glutamate. He propounded the taste different from sweet, sour, bitter and salty and named this distinctive fifth taste as 'umami' – which translates as 'savoury' or "delicious taste" in Japanese – and is associated with a "meaty" flavor. He patented 'MSG' as a taste substance for seasoning in food⁹. Researchers revealed MSG is the most common non-essential amino acid (means that our bodies produce it, even if we do not get it from the food we eat) and that can be easily metabolized by human body^{6,11}. The body

itself generates approximately 50 grams of free glutamate per day for use as a component of metabolism and in addition, approximately two kilograms of naturally occurring glutamate can be found in the body's organs and tissues, including the brain, the kidneys, the liver and various muscles⁹. Glutamic acid can be synthesized from oxoglutaric acid, formed in the metabolism of carbohydrates and is also occurring naturally in human bodies as a component of many proteins and peptides of most tissues and serves as the building blocks of life. Human plasma contains 4.4-4.5 mg/l of free glutamic acid and 0.9 mg/100 ml, of bound glutamic acid. Human urine contains 2.1-3.9 µg/mg creatinins of free glutamic acid and 200 µg/mg creatinins of bound glutamic acid. Human milk contains 1.2% protein of which 20% is bound glutamic acid which is equivalent to 3g/l calculated as sodium glutamate and the free glutamic acid concentration is 300 mg/l (Infants like breast milk because the taste is enhanced by MSG) in contrast cow's milk contains 3.5% protein equivalent to 8.8 g/l calculated as MSG, but only 30 mg/l free glutamic acid¹⁰. MSG is a major constituent of protein-rich food products e.g. meat, poultry, fish, mushrooms, seaweed, tomatoes, potatoes, nuts, legumes, and in most of the dairy products⁵. It is found mostly in the bound state and the fraction in a free form enhances the flavor of foods⁹. Researchers further identified and confirmed the presence of receptors on human tongue that exclusively activates by glutamate. Many fermented or ripe foods are rich in natural MSG, such as ripe tomatoes (250-300 mg/100g), parmesan cheese (1600 mg/1000g), Roquefort cheese (1600 mg/100g) and Gouda cheese (580 mg/100g). The glutamate content in milk/milk products, poultry products, meat, fish, and vegetables differ in their bound and free form. (Table1)

Table1: Natural glutamate content of fresh food.

Values: mg/100g

Food	Bound Glutamate	Free Glutamate
Milk/Milk Products		
Cow Milk	819	2
Human Milk	229	22
Parmesan Cheese	9,847	1200

Food	Bound Glutamate	Free Glutamate
Poultry Products		
Eggs	1,583	23
Chicken	3,309	44
Duck	3,636	69
Meat		
Beef	2,846	33
Pork	2,325	23
Fish		
Cod	2,101	9
Mackerel	2,382	36
Salmon	2,216	20
Vegetables		
Peas	5,583	200
Corn	1,765	130
Beets	256	30
Carrots	218	33
Onions	208	18
Spinach	289	39
Tomatoes	238	140
Green Peppers	120	32

Source: Institute of Food Technologies, 1987⁸.

TASTES & HUMAN TASTE BUDS

Human taste-buds are primed to distinguish between at least four basic tastes: salty, sour, bitter, and sweet. It's long been suspected that we also have taste receptors specifically designed to detect one more basic taste "umami".

In November 2005, it was reported that a team of French researchers experimenting on rodents claimed to have evidence for a sixth taste, for fatty substances, believing the CD36 receptors that they found on rodents, were important for evolutionary reasons. It is speculated that humans may also have the same receptors.

Human taste-buds also distinguish between Spicy & Astringent.

Sweet and Umami flavors are innately appetizing, whereas Sour and Bitter ones are instinctively unappetizing. Saltiness is enticing up to a certain amount, and beyond that it becomes repulsive.

Scientists have also discovered glutamate receptors in our gut. It's presumed these receptors signal the brain to prepare for the digestion of protein-rich food, which supports the theory of taste as an indicator of nutrition. It goes like this: Humans tend to like sweet tastes because they signal to our body that we're consuming carbohydrate energy. It may follow that we tend to like umami because it sends a signal to our body that we're consuming the protein our bodies need.

IMPORTANT DISCOVERIES RELATED TO MSG

There have been numerous studies on umami taste and glutamate and their relation to food palatability and flavor acceptance.

IMPORTANT DISCOVERIES RELATED TO MSG

Year '1866' L-glutamic acid, firstly discovered by Karl Rithausen, a German Scientist.

Year '1908' Prof. Kikunae Ikeda, a Japanese Scientist identified the unique taste of umami attributed by glutamic acid; which turned as a 5th basic taste distinguished by human taste buds in addition to salty, sour, bitter, and sweet.

Year '1913' Kodama, isolated 5'-inosinic acid from skipjack as another key component of the konbu seaweed stock.

Year '1957' Kinoshita explored a bacterial strain "Micrococcus glutamicus" (Later changed to "Corynebacterium glutamicus") which could produce and accumulate large amounts of L-glutamic acid.

Year '1960' Kuninaka isolated 5'-guanylate and recognized its role as key component of umami taste in the broth of dried shiitake mushroom.

USES OF MSG

MSG is majorly used in food applications and in food processing industries e.g. convenience foods, snacks, soups, instant noodles, condiments, and seasoning blends in permissible limits. A negligible amount of MSG is used in animal feeds. MSG is

containing 78% of glutamic acid, 22% of sodium and water. By adding MSG in food appropriately, the sodium chloride addition could be reduced by 30-40% while maintaining the same perception of saltiness. Production of the chelating agent glutamic acid *N,N*-diacetic acid tetra-sodium salt (GLDA) is a new and promising end use for MSG but accounts for a very small share of global consumption. Glutamate is sometimes added to food to reduce cooking and meal preparation time to provide more flavors.

MSG BENEFITS

MSG contains only 30% of the amount of sodium in table salt, and gives the same flavor enhancement in food.

Food naturally high in glutamate or the inclusion of MSG in food increases taste of the food and therefore, improves the amount of intake and improves desire for the food.

Glutamate is the primary source of energy for the intestine and dietary glutamate is instantly utilized by the intestine.

Dietary glutamate derived from foods and from MSG, plays important role in the digestive system, serving as a primary source of energy for the intestine.

Free glutamate triggers the digestive process for proteins as soon as *umami* taste is recognized by the brain.

A study revealed glutamate as an intestinal oxidative fuel, key neurotransmitter, and may be a useful dietary supplement to augment health of the infant gut and therefore, it may play a functional role in promoting gastric emptying and digestion. Another study informed about alphas-ketoglutarate (AKG), which is formed during the metabolism of the amino acid glutamate is also useful as a dietary supplement to provide a specific energy source for the developing gut in infants.

A study showed a positive role of MSG in the improvement in haemoglobin level to those who were anemic at baseline¹². It is necessary to carry out further studies before drawing such conclusions.

A study reported about the development of a readily biodegradable chelating agent called tetra-sodium L-glutamic acid, *N,N* di-acetic acid (GLDA) from flavor enhancer MSG in an essentially waste free synthesis, which will replace phosphates in automatic dishwashing detergents that is highly soluble than conventionally used EDTA and will be offered in higher concentrations; reducing the packaging and transportation cost.

PRODUCTION & CONSUMPTION OF MSG

In the first half of 20th century, MSG was produced by extraction from wheat, soybean and other plant protein sources after hydrolysis by concentrated hydrochloric acid. Later, it was discovered that, MSG is made by either a bacterial fermenting process, protein hydrolysis (a breaking of protein into its constituent amino acids), or by synthesis. Modern commercial MSG is produced by fermentation of starch, sugar beets, sugar cane, or molasses. It is also made from corn in Iowa through a fermentation process similar to that of making cheese and yogurt. Hydrolyzed proteins used by the food industry to enhance flavor are simply proteins that have been chemically broken apart into amino acids. MSG production capacity is largely concentrated in Asia, where feed stocks (such as tapioca from cassava and molasses from sugarcane) and labor are abundant and inexpensive and where demand is highest. Asian production capacity accounted for approximately 94% of world MSG production capacity in 2014. China, Indonesia, Vietnam, Thailand, and Taiwan are the major producing countries in Asia. China is largely responsible for the recent increases in world production and consumption of MSG. Currently, China is the world's largest MSG producer and consumer. In 2014, Chinese production and consumption accounted for approximately 65% and 55% of world production and consumption, respectively. China is also the world's largest exporter of MSG; in 2014, the nation provided approximately 44% of the world's MSG exports. The second-largest exporter, Indonesia, supplied 16% of the world's MSG exports³.

MARKETING OF MSG

MSG was marketed in 1909 as '*Ajinomoto*' for a seasoning in food by the food and chemicals corporation of Japan '*Ajinomoto Kabushiki-gaisha*' with Prof. Ikeda (Founder of MSG)⁷. Soon '*Ajinomoto*' was adopted as a culinary agent over worldwide in many recipes. In 1946, the company itself changed its name as '*Ajinomoto Co., Inc.*' and established its sales offices in many other countries. China, Indonesia, Vietnam, Thailand, and Taiwan are the major producing countries for MSG in Asia. The company describes itself as a global manufacturer of seasoning, processed foods, beverages, pharmaceuticals and specialty chemicals, with specialization in a wide ranging application of amino acid technologies, clocking a turnover of \$10.23 billion in 2015 and 70% growth in retail applications like flavor seasoning. Asia accounted for 88% of the world's MSG consumption in 2014 with China the largest producer, consumer and exporter with a share of 65%, 55%, and 44% respectively. The second-largest exporter, Indonesia, supplied 16% of the world's MSG exports. Ajinomoto India (established in 2003) has so far been importing and supplying MSG under its brand name '*Ajinomoto*' and inosinate, guanylate, food items, chicken and mutton masala under the brand name '*Hapima*'. The Japanese multinational '*Ajinomoto Co Inc*' is now setting up a manufacturing base in Tamil Nadu for mainly the raw materials needed for MSG production e.g. sugarcane and tapioca are available in plenty in the State and the company has taken up space in the 1,500-acre industrial park, at Kancheepuram. At present, Ajinomoto India is importing MSG from its sister unit in Thailand and re-packs the same at a plant near Chennai. India is importing ajinomoto to meet its increasing demand in food processing industries, local households, eating hubs, hotels, and restaurants, with a price value touching to rupees 'twenty eight lakh crores' and also exporting MSG with a price value touching to rupees 'nineteen lakh crores'. (Table2)

Table2: India's Total Exports and Imports of Monosodium Glutamate '*Ajinomoto*'.

Values: In Rs. Crores

Year	Total Export	Total Import	Difference
2008 - 09	840755.1	1374435.6	-533689.5
2009 - 10	845533.6	1363735.6	-518202.0
2010 - 11	1136964.3	1683467.0	-546502.7
2011 - 12	1466959.4	2345463.3	-878503.9
2012 - 13	1634318.3	2669162.0	-1034843.7
2013 - 14	1905011.1	2715433.9	-810422.8
2014 - 15	1896348.4	2737086.6	-840738.2
2015 - 16	1849428.8	2577665.6	-728236.8

Source: Department of Commerce, Govt. of India

MSG CONTROVERSIES

A hypothetical MSG symptom complex, named "*Chinese Restaurant Syndrome*", attracted attention in the period after 1968, when Robert Ho Man Kwok, an American Doctor reported in an article in the New England Journal of Medicine about the symptoms he felt after an American Chinese Meal⁷. Kwok suggested possible reasons for his symptoms, including alcohol (from cooking with wine), sodium, and MSG. Many other reports targeted MSG, for it could produce Kwok's symptoms such as numbness, weakness, flushing, sweating, dizziness and headaches¹⁰. In addition to Kwok's symptoms, many more studies reported other health issues probably caused due to a heavy or prolonged intake of MSG viz. overweight or obesity, hypertension with sleep-disordered, breathing problems, neurological disorders, kidneys disorders, allergic reactions, causing cancer, and killing of dogs.

FINDINGS OVER CONTROVERSIAL ASPECTS OF MSG

Reported Chinese Restaurant Syndrome and other supporting adverse event reports triggered the US Food and Drug Administration (FDA) to ask an independent scientific group Federation of American Societies for Experimental Biology (FASEB) to conduct a study in 1990's. The 1995 report compiled by FASEB on behalf of FDA stated that MSG is generally recognized as safe

(GRAS). FDA says that MSG occurs naturally in many foods and people around the world have eaten glutamate-rich food throughout the history. Outcome of the study concluded no evidence for MSG food intake and serious or long term medical problems.

A study at Virginia to check CRS symptoms, in particular, flushing of skin after feeding 24 subjects with 3 gram and 5 gram doses of MSG found no MSG-provoked flushing.

One of the largest studies in 1998 using double-blind placebo-control testing, which was done with 130 subjects who declared to have MSG intolerance found no adverse reaction with MSG or placebo when taken with food.

In a double-blind crossover study done by two Italian scientists examining 17 males and 7 females, between the ages of 18 and 34 administering 3 gram doses of MSG reported a number of CRS symptoms, including headache, flushing and tightness in the chest, whereas the group that received the actual MSG broth reported no such symptoms¹¹.

The joint FAO/WHO Expert Committee report on Food Additives (JECFA) reported that the controlled double-blind crossover trials have failed to demonstrate the relationship between Chinese Restaurant Syndrome 'CRS' and MSG intake⁷.

Many studies reported for any reactions that were observed with intake of MSG were mild, transient and not life-threatening and many other studies did not support CRS symptoms with or without MSG in food.

A few studies revealed for healthy MSG-intolerant people, the MSG symptom complex tends to occur within one hour after eating 3 grams or more of MSG on an empty stomach or without other food.

Allergic reactions, generally takes place due to a food containing protein. MSG is a sodium salt form of a glutamic acid or glutamate that can be found in protein, but with no link to any other

molecule for being in the free form. Some people are allergen to certain food intake whether with or without containing MSG. According to the American College of Allergy, Asthma and Immunology, MSG is not an allergen.

Adverse effects of consuming MSG also predominantly exist in people sensitive or allergic to some part of the food or to the people pre-existing vitamin B6 deficiency.

Studies on overweight or obesity differed in their outcomes. Some preliminary scientific studies suggested an association with high doses of MSG and increased risk of obesity and metabolic syndrome.

A study on hypertension linked to suspected MSG intake reported a positive link. Another study argued with MSG contains only 30% of the amount of sodium, which is clinically proven to be a related cause of high blood pressure and is largely found in table salt. Switching over to MSG at far lower levels gives the same flavor enhancement in food.

The use of MSG was found to have no relationship to blood glucose or cholesterol⁷.

Studies showed no link between neurological disorders and MSG intake.

Studies could not reveal headache associated with MSG intake. A study argued "If MSG is a problem, why doesn't everyone in China have a headache?"

In a study, it is found that MSG could increase the gastrointestinal motility that could explain gastro esophageal reflux. This reflux is associated with obstructive sleep apnea (OSA)¹³.

A study conducted on rats with different doses of MSG for a number of days reported its adverse effects on kidney functions, as the serum urea and serum creatinine were significantly increased and a significant increase in liver and kidney weight of the rats was observed. Counter checks suggested oxidative stress due to long chain polyunsaturated fatty acids makes kidneys susceptible to damage and MSG may not be the

real cause¹. Further studies are needed to support the outcome vis-à-vis on humans.

A study stated that “when certain amino acids are heated to 350-500°C or 660-900°F, certain cancer causing compounds could be formed”. A study argued those findings, as the dietary intake of glutamate does not require temperature to this extreme and the normal cooking temperatures are generally below 250°C.

A study conducted in Philippines by feeding MSG to a group of 15 dogs over a period of 4 months with variable doses result them in a healthy condition. Further, most dog foods often contain MSG.

The average daily intake of MSG is estimated to be 0.3-1.0 g in industrialized countries, but can be higher occasionally, depending on the MSG content of individual food items and an individual's taste preferences. Recently, in the year 2015, many states in India banned Maggi noodles and its variants because of high levels of lead content against permissible limits and a false declaration of no added MSG found in some samples. According to Food Safety and Standards Rules, 2011, MSG is permitted in the seasoning used for noodles and pastas and not in their dried products. Pre-cooked pastas, noodles and like products are pre-gelatinised, heated and dried prior to sale and are governed by Codex International Standards of food safety recognized by WHO. The masalas used in these noodles includes herbs, spices, seasonings and condiments, in order to enhance the aroma and taste of food. MSG is not permitted to be added to over 50 food items in India including the food for infants below 12 months.

CONCLUSION

MSG has been used for more than 100 years to season food or to enhance flavor of the food. Undesirable health symptoms reported by some investigations on different aspects in consuming MSG at various levels has always been an issue of concern. Most people can consume dietary glutamate in large amounts or their body can metabolize glutamate efficiently. There have been no known or scientifically proven studies that link adverse

reaction among human-beings to MSG except to those, sensitive or allergic to some part of the food or to people, those are pre-existing to vitamin B6 deficiency and also a large amount of MSG intake may cause certain health issues. A review data from the World's top scientific sources reveals that MSG is safe for human consumption and so as the international and national bodies governing food additives. Under the Indian food laws, MSG is a permitted additive in foods with labels to indicate its presence. Use of MSG in the food processing industries is a sector with promising leaps and bounce for growth in times to come. Many studies revealed important benefits of glutamate to human health, beyond its role as a food component. MSG can provide significant nutritional benefits to elderly people to whom losses in taste and smell restrict desire for food intake. More studies are needed on humans to combat any adverse link of MSG intake on overweight/obesity, cancer, and on kidney functions. In contrary to neutralized or newly emerged ifs & buts on MSG consumption; its demand is increasing worldwide with a huge money exchange. There is enough economic potential for India to cater the increasing world over demand for MSG through available abundance in raw materials, manpower, and the well trusted vegetarian agro sources.

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INDOOR AIR POLLUTION

Shifali Abrol

Indoor air pollution is a significant problem in both homes and offices in both urban and rural areas. This is because people spend around 90% of their time indoors. Although one pollutant may not cause a significant damage, most of the homes have more than one source of indoor air pollution, thus causing a cumulative effect.

INTRODUCTION

Air pollution is one of the major problems affecting the environment today. The pollutants can be both primary (oxides of sulphur and nitrogen) and secondary (PAN). Air pollutants can pollute both the indoor and outdoor environment. Presence of pollutants in indoor air is known as indoor air pollution. It can be traced back to prehistoric times when man started using fire for cooking, lighting etc. Fire led to high level of indoor pollution, the evidence of which is soot found in prehistoric caves¹.

Indoor air pollution has been included in the top five risks to public health as per USEPA². It has been found that the level of indoor air pollutants is ten times more than its level outside and the concentration of pollutants has also been known to exceed permissible limits³.

There are various sources and types of indoor air pollutants. Production and behaviour of pollutants in the indoor environment is affected by the temperature, humidity, pressure and speed and direction of wind outside. Some gases like sulphur dioxide and ozone while infiltrating the indoor environment are absorbed easily by materials and are in high concentration only when the outdoor concentration is high. Amount of ventilation also affects the behaviour of pollutants. Accumulation of pollutants can occur because of poor ventilation, thereby causing significant health damage. More than 3 billion people depend on solid fuels including biomass, wood dung and agricultural wastes and coal

to meet the basic energy needs. Burning solid fuels produces high levels of indoor air pollution. Typical 24 hr levels of PM₁₀ in biomass using homes range from 300-3000 µg/m³. By comparison the WHO air quality guidelines recommend a limit for daily average PM₁₀ is 50µg/m^{3,4}.

Some of the pollutants include

Pollutants emitted from construction material within home, furniture, paints, adhesives etc. Asbestos is an important constituent of roofing material, floor tiles, pipes etc. Formaldehyde, a colourless, pungent-smelling gas is another important indoor pollutant used widely by industry to manufacture building materials and numerous household products. Sources of formaldehyde in indoor environment include building materials, household products, and the use of unvented, fuel-burning appliances, like gas stoves etc. Benzene, a genotoxic carcinogen is released from smoking, construction material, solvents etc.

Pollutants emitted from combustion of fuels indoors. These include oxides of sulphur, carbon, nitrogen, particulate matter etc.

Pollutants that infiltrate from outdoor sources such as ozone, oxides of carbon, particulate matter⁵.

Biological pollutants such as bacteria, fungi, virus, dust mites, pollens, insects etc⁶.

Tobacco smoke is another important air pollutant. Tobacco smoke contains only oxides of carbon, nitrogen and benzopyrene which is

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known to be a carcinogen⁷ reported tobacco smoke as a source of contamination of indoor air thereby contributing to development of asthma.

Radon, a colorless, odourless gas is harmful and radioactive in nature. It enters homes through cracks in concrete walls and floors and is emitted from tap water, cooking gas, construction material etc⁸. The predominant health effect associated with exposure to elevated levels of radon is lung cancer.

Suspended particulate matter is produced during combustion of fuels, handling and loading of materials, construction of buildings, roads and from sources of transportation. PM includes organic, inorganic matter, several metals, radionuclides, polycyclic aromatic hydrocarbons (PAH) etc. Exposure to PAH occurs due to inhalation of particulate matter.

For every $10\mu\text{m}^3$ increase in concentration of particulate matter of less than $10\mu\text{m}$ in diameter, there is an increase in mortality by 0.6- 1.6%. PM has been found to be one of the most dangerous pollutants to human health^{9,10}. The toxicity of particulate matter is attributed to the high content of heavy metals which accumulate in the cells¹¹.

Deterioration of indoor air leads to various health effects. The effects may manifest after single or repeated exposures. People inhale around 6-10 litres of air per minute; hence the quality of indoor air is of immense importance¹². Air pollutants are associated with a number of health effects such as fever, cough, asthma¹³, headache, nausea, cancer³ and even death¹⁴. Indoor levels of some carcinogenic chemicals are 5 to 70 times higher than outdoor environment¹⁴.

Over 2 million deaths occur annually because of $\text{PM}_{2.5}$ ¹⁵. Particulate matter is also reported to be the second largest cause of lung cancer¹⁰. $\text{PM}_{2.5}$ is known to cause diseases of respiratory and cardiovascular system and also affect immunity.

VOC like formaldehyde may cause nausea, irritation of mucus membrane, headache, fatigue and insomnia, watery eyes, burning sensations in the

eyes and throat etc. High concentrations may also enhance risk of asthma.

Aerosols produced from coolers and air conditioners may cause Legionnaires disease which is a type of pneumonia. Sick building syndrome characterized by dry skin, headache, fatigue, lack of concentration and eye irritation is also known to result from inadequate ventilation¹⁶.

Exposure to indoor smoke has been known to double the risk of many respiratory disorders in children. According to WHO, nearly half of deaths among children due to acute respiratory infection is because of indoor air pollution.

Biological pollutants are known to cause different types of human diseases like infection, hypersensitivity diseases and toxic diseases. Allergic reactions include allergic rhinitis, asthma etc. Allergic reactions occur immediately upon re-exposure or after multiple exposures to a specific biological allergen. Moulds and mildews release disease-causing toxins. Symptoms include sneezing, watery eyes, coughing, shortness of breath, dizziness, lethargy, fever etc.

Oxides of carbon and nitrogen are known to be associated with respiratory symptoms, increased bronchial reactivity, airway inflammation, decrease in immune defence, leading to increased susceptibility to respiratory infection.

Prevention and abatement of indoor air pollution is of critical importance today. Strategies need to be devised by the government, non government as well as international organisations for the abatement and control of indoor air pollution.

Ventilation such as roof and wall permeability has reduced the average household pollution greatly. Several studies indicate that the kitchen location, ventilation, and permeability of roofs and walls affect smoke exposure significantly. There should be standard settings for ventilation.

Guidelines and standards for measurement of indoor air quality should be followed. Designing of monitoring programmes for selected pollutants should be done. Also, parameters such as type, size,

age, location should be specified in indoor quality protocol. Guidelines recommended by WHO provide a basis for the protection of public health from the harmful effects of exposure to chemical present in indoor air¹⁷.

Switching from wood, dung or charcoal to efficient modern fuels such as kerosene, LPG and biogas would bring about largest reduction in indoor smoke. Therefore subsidies on cleaner fuel technologies should be encouraged.

Use of indoor plants for absorption, degradation and detoxification of pollutants is another important method for control of indoor air pollution. *Chlorophytum comosum* L. was reported to be used for phytoremediation of particulate matter from indoor air¹⁸.

Humidifiers are known to become breeding grounds for biological contaminants, therefore evaporation trays in air conditioners, dehumidifiers, and refrigerators should be cleaned frequently.

Education plays an important role in controlling indoor air pollution. There should be information campaigns for general population and specific groups. There should be inclusion of indoor air quality (IAQ) information in schools and university curriculum.

Indoor Air Quality is an important determinant of health; hence further research on various factors leading to indoor pollution, its effects and prevention becomes imperative.

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REVIEW ON BIO-BEDS: COST EFFECTIVE DESIGN FOR THE REMOVAL OF PESTICIDES

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Presence of pesticide residues in farmyards affects the physico-chemical properties of land and surface water. The need for simple, effective and eco-friendly methods to minimize environmental contamination from pesticide resulted in the construction of Bio-beds that degrades pesticides. This review discusses about the importance of Bio-beds in environmental remediation.

INTRODUCTION

Bio-beds

Presence of pesticide residues in farmyards due to accidental splashes or spills and mismanagement of pesticides has led to serious environmental issues. Pesticide residues in the agricultural lands may be subsequently washed off which contributes towards the release of significant proportion of pesticide load to the surface water. Bio-beds is a potential solution for environmental deterioration caused by the delinquency of pesticides in agricultural fields, spray tanks and other pesticide handling areas. Bio-beds were initially developed in Sweden in early 1990s in response to the need of a simple and efficient method to minimize environmental pollution due to the unsatisfactory management of pesticides¹. Bio-beds are simple and cheap to construct with increased sorption capacity and high microbial activity to lock up and degrade pesticides³. A bio-bed is an excavated pit filled with straw, soil and peat covered with a layer of grass³ that has been characterized to reduce the levels of pesticides in agricultural wastewater by several folds. The straw which is the main substrate in the bio-beds enhances the microbial activity, thereby producing enzymes with broad specificity making them suitable for the degradation of a mixture of

pesticides. Thus high amount of straw in the bio-mixture is recommended but the homogeneity of the bio-beds gets affected when the volume percentage of straw exceeds 50% leading to decrease in efficacy⁴. The soil and peat promotes the sorption capacity of the Bio-beds⁵, whereas the top grass layer contributes towards increasing the efficiency of bio-beds by creating upward transport of water thus regulating the moisture of the bio-beds⁵. The pesticide residues present in the runoff from agricultural fields are retained in the bio-beds owing to its sorption capacity. The locked up pesticide molecules are dissipated by the action of various enzymes like phenol oxidase produced by the increased microbial activity⁴. The fungal and bacterial transformations of pesticides was observed in the bio-beds which not only contributes towards the degradation of the pesticides but also helps in the breakdown of other organic pollutants⁵. The abiotic degradation of pesticides in the bio-beds is promoted by the activity of peat. Thus bio-beds are characterized as a eco-friendly and low cost method to filter out and degrade pesticides from agricultural runoff which can be constructed by the farmer in his land.

Types of Bio-beds

Bio-beds are broadly classified into two major types (Unlined and Lined) based on whether the bottom of the bio-beds is separated from the environment.

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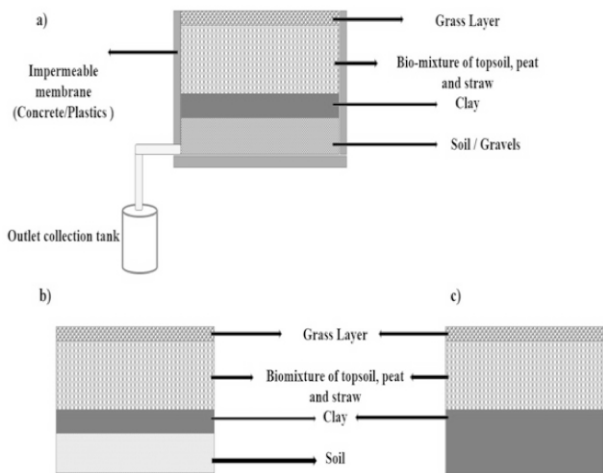


Fig. 1: Lined Bio-beds (a) Unlined Bio-beds with an added clay (b) or a natural clay layer (C)⁶.

Lined Bio-beds

Lined bio-beds are considered as the original Swedish Bio-beds, but lining of synthetic impermeable layer which can be either made up of plastic, concrete, tarpaulin, etc, which helps in their isolation from the ground . Here all filling, mixing and sprayer wash-down takes place on the impermeable layer. Lined bio-beds along with drainage are extremely effective at retaining and degrading the residues of pesticides. Mostly the drainage layer comprises of gravel, macadam, sand and it is placed below the layer of clay, but the drawback of lined bio-beds is, it does not cope with large volume of waste associated with tank and sprayer water washings due to water logging consequences . Other than these types, there are Bio-beds all over the world which are uniquely designed and named. They are tabulated below:

Table1: Unique names of Bio-beds in different countries⁶.

S.No	Name of Bio-beds	Country	Ratio of components (straw, peat, soil) (vol%)
1	Bio-beds	Sweden	50:25:25
2	Biomass bed	Italy	40:20:20
3	Bio-beds	UK	50:25:25
4	Bio filters	Belgium	70:30 (Peat free compost)
5	Bio-beds	Latin America	50:25:25

From the above tabulation, it is evident that in most of the countries around the world they use the common name as Bio-beds and the volume% is 50:25:25. It comprises of straw, peat and topsoil and it is considered to be the most advisable and beneficial ratio for the construction of Bio-beds to yield a higher rate of degradation.

Unlined Bio-beds

Unlined Bio-beds are free of impermeable synthetic layer which makes an association and interaction with the ground. Generally a layer of natural clay is observed at the bottom of the bio-beds pit. If not, a clay layer is supplemented to the pit⁴ . The applicability of unlined Bio-beds evacuated the essentiality to manage the input of water and in parallel it maintains the time near optimum limitation for pesticide degradation as rainwater readily percolates and subsequently drains out. The main drawback of unlined bio-beds is that collection of drainage water is absent in this system.

COMPONENTS AND CONSTRUCTION

Bio-beds is a simplest form of pit in the ground filled with a bio-mixture of topsoil, peat and straw. It is covered with a layer of grass and equipped with a ramp enabling the tractor and sprayer to be driven over the bed⁵ . In recent days peat- free compost is used in the mixture as it is more eco-friendly when compared to peat mould that has been used in the past⁵ . The components of Bio-beds varies according to its types.

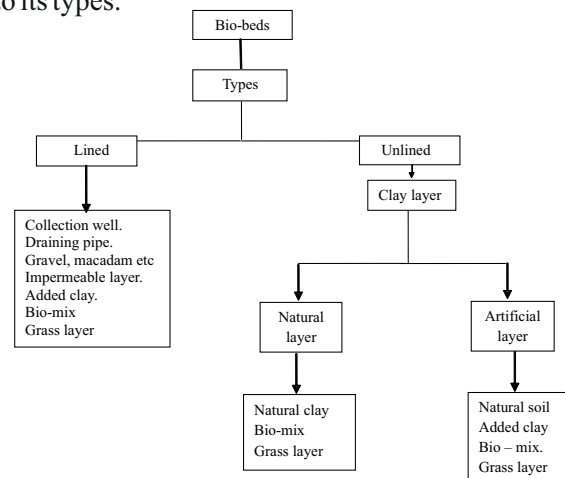


Fig. 2: Types of Bio-Beds and their Composition

The natural or added clay occupies a height 10cm from the surrounding soil layer and the ramp is supported by wooden retaining frames on either sides. Increase in the thickness of the bio-beds would further increase its activity against pesticides⁷. Major part of the bio-beds is occupied by bio-mix (50cm) consists of a mixture of top soil (25%), chopped straw (50%), peat mould (25%). The topsoil is rich in humus content and maintains the bioavailability. Before the construction of bio-beds, a sample of topsoil is air dried, passed through a 5.4 mm mesh sieve and refrigerated with the bio-mix⁴. The peat mould is eco friendly and provides sites for sorption and helps in maintaining the water balance in the system⁴. Increase in the amount of straw stimulates the degradation of pesticides, however above 50% is not advisable for practical use in Bio-beds systems⁴. Many test chemicals like metamitron⁸, chloridazon⁸, isoproturon^{9,2}, linuron⁸, metribuzin⁸, terbuthylazine^{8,9} are degraded in the bio-beds system based on their physico-chemical properties such as sorption potential, water solubility and degradation rates⁴.

INFLUENCING PARAMETERS

The ability of the bio-beds to retain and degrade the chemical pesticides depends on various parameters which influences the degradation process either by increasing or decreasing the activity of the bio-beds. Effect of such parameters on the bio-beds system are discussed below:

Effect of temperature on pesticide dissipation

Temperature has a significant effect on the dissipation of test chemicals. The rate of dissipation of pesticides increases with increase in temperature and the highest dissipation rate is observed at 20°C in the bio-beds mixture containing straw, peat, soil in the ratio 60:30:10 in vol% where all the pesticides are completely dissipated⁸. A highly efficient bio-bed should maintain optimum temperature throughout the process.

Effect of bio-mixture on degradation and sorption of pesticides

Binding and degradation of pesticides are affected by various parameters such as homogeneity,

composition, age, moisture content and temperature. A good bio-mixture promotes effective pesticide binding with an efficient and robust microbial flora which enhances the pesticide degradation rate at higher concentrations by several times with repeated applications⁶. The use of lingo-cellulosic materials in bio-mixture has many practical advantages as they are persistent, readily available on farms, and their slow degradation rate allows continuous supply of nutrients. However, it has an effect on the microbial flora⁶. Homogeneity of the bio-mixture enhances activity of the bio-beds in retaining and degradation of pesticides.

Effect of concentration of straw in the bio-mix

Readily available carbon sources, cellulose and hemicelluloses released after the degradation of lignin contributes more to respiration processes and also the phenol oxidases content depends on lignin degradation. Straw contains both readily available carbon sources and those that are linked to lignin degradation, which probably explains why straw content is an important parameter to be considered for effective degradation of pesticides⁸.

Effect of repeated applications on degradation rate

Repeated addition of mixture of pesticides to topsoil and bio-mix significantly decreases the rate of degradation of test chemicals which can be enhanced by refilling the bio-pit¹.

CONCLUSION

Bio-beds are considered as an economic solution for pesticide disposal as they are relatively cost efficient. Construction of bio-beds are simple and they are eco friendly. They are one among the biological methods that are facile to use. Significant acceleration of natural breakdown process of pesticides is an immense advantage of bio-beds system. Besides several advantages there are certain constrains. Construction of bio-beds requires lots of space. Moreover the major predicaments are, it has a high moisture content and high rates of weed growth where weedicides cannot be used to control the growth. Uniformity and permeability plays a major role and it should be monitored. In order to overcome

these constrains and to accomplish the quality of bio-beds, future researches should be contributed in effective design of bio-beds. Process control should be emphasized and specific organisms should be used in order to control weeds as an alternative for weedicides. Extensive exploration is required to introduce methods in increasing the mobility of pesticides thereby increasing the rate of degradation. The efficacy and accuracy of bio-beds systems make them felicitous for use in developing countries and hence centralization on their development leads to commercialization of this technology resulting in the degradation of pesticides.

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PARASITES AS EMERGING BIOMONITORING TOOLS

Ummer Rashid Zargar

The environmental relevance of parasites in the impact assessment has opened up new interdisciplinary field (i.e. Environmental Parasitology) that encourages the positive role of parasite which were traditionally considered as an infecting agent. The interest in this field started in 1980's during the era when biotechnology was leading in all fronts and parasitology was considered as trivial field with no innovation. However, importance of parasites came into limelight when ecologists were in search of new biological sentinels for ecological assessment. Today we find different groups of parasites showing great promise as indicators of environmental status of stressed ecosystem. In India, we have paid least attention towards these biomonitoring tools due to preference of traditional indicators. However, parasites have been tested by researchers in lakes of North Western Himalayan region, where they have shown great promise which is seldom possessed by conventional indicators. Knowing the important of parasites in relation to environment, there is urgent need to include these biological organisms for routine impact assessment programmes.

INTRODUCTION

The terms 'Parasite' and 'Parasitism' have been always matter of interest for researchers from time immemorial. Although meaning of Parasite has not changed a lot during last 100 years but recent advances in various fields have unfolded new debate about the roles played by these tiny creatures at different levels. Traditionally parasites were considered as infecting agents that pose tremendous damage to the living organisms. Parasitism has been considered as '*a life of large income without work*' which shows that they are mostly dependent on the host for carrying out various activities of life. Most veterinarians and medical practitioners have similar view about parasitism; nevertheless, there has been paradigm shift in recent years with relation to roles that are being played by parasites (Fig. 1). Majority of parasitologists also consider parasites as detrimental agents that have more disadvantages than advantages. However, narrative about parasite changed in the third quarter of 20th century, when researchers found immense biomonitoring potential in different parasite groups.

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This stems from the fact that parasites play critical role in shaping up the biodiversity pattern and ecological principles^{1,2}. In last decade, ecological parasitologists deciphered various positive roles of parasites that look contradictory to the common notion about these tiny creatures. For example, Thomas *et al.* (2000)³ critically reviewed how hosts parasitized with parasites have added advantage over the hosts with no parasitic infection.

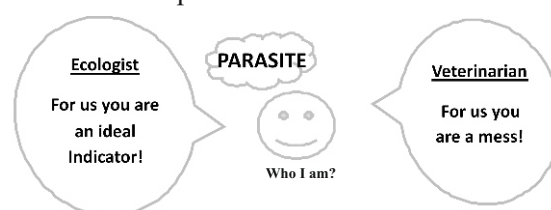


Fig.1. Perception regarding Parasite among different professionals.

The concern about the degradation of environmental by various pollutants came into limelight in late 1960's and there was major shift in the policy making by the governments across the globe. The credit for initiating the campaign against environmental perturbations goes to Rachael Carlson, who succeeded in persuading the west about the ill consequences of non-biodegradable pollutants

on biological organism. However, her efforts were not enough to prevent the mass scale environmental devastation and it was felt in the early 1980's that researcher need to focus on multipronged approach to deal with the emerging environmental problems. The assessment of environment by using biomonitoring approach was suggested to provide better picture of environmental quality as conventional chemical analysis had many loopholes. With this aim in mind, ecologists were in search of emerging biomonitoring tools that might have advanced features for impact assessment studies. The elucidation of ecological significance of parasites paved the way for analyzing their role in environmental monitoring and thus began the era which stressed on the positive roles of parasite. The early success of parasites in the impact assessment studies drew attention of many ecologists and environmental managers to use the potential of these organisms for environment management. The pioneering work on the environmental relevance of parasites was carried out during late 1980's which flourished in the 1990s and 2000s decades. Others made significant contribution to give impetus to notion that parasites are useful sentinels in environmental monitoring⁴⁻¹⁰.

Environmental biologists have shown keen interest in parasites for pollution analysis due their unique features that are seldom possessed by other biomonitoring sentinels. Over the years, a separate branch of science known as Environmental Parasitology, an interdisciplinary discipline has emerged that takes care of various environmental and ecological roles of parasites. With the creation of this platform, new comers in parasitology research have taken up various research problems dealing with association of parasites with altered environmental quality. With substantial breakthroughs in last two decades, environmental parasitologists have been able to bring parasites on the fore front so that their ecological roles are being accepted by non-parasitologists.

BIOMONITORING WITH PARASITES

Biomonitoring has been essential part of

environmental policy in the present era due to the fact that multiple pollutants have made inroads in various ecosystems. The importance of biomonitoring tools can be judged by the fact that these sentinels have the capacity to reduce the chances of uncertainty in the risk assessment of new emerging contaminants. There has been global effort from various ecologists and environmental scientists to find management solutions to urgent global environmental issues, including climatic change, habitat loss and fragmentation, pollution and contamination, disease outbreaks, and the spread of invasive species. Among number of strategies that has been proposed for management of environment, one of the most popular has been to adopt monitoring techniques that can detect ecological changes both at an early stage and over the long term. The inclusion of biological monitoring in the environmental decision making allows for better-informed and more cost-effective management decisions.

In layman sense biomonitoring is a technique that takes the advantage of various biological organisms, such as algae, macrobenthos, insect, parasite etc. for the impact assessment purposes. In past 20 years, there has been convincing evidence that biomonitoring approach has several advantageous attributes that are lacking in conventional chemical analysis technique (Table 1).

Table 1 Benefits and drawbacks of chemical analysis and analysis with parasites.

Benefits	Drawbacks
Chemical Analysis	
Chemical Analysis (CA) provides detailed information about the status of specific contaminants	Chemical Analysis does not give us details about the pollutants that are not included in the analysis
CA has an advantage that it can be easily related to legal limit values and even limit values can be determined	CA is unable to detect the multiple interaction that take place between various pollutants

Benefits	Drawbacks
Chemical Analysis	
CA is based on standardized methods with high accuracy and repeatability	There is no provision for interaction with the environmental
Biomonitoring with Parasites	
Parasites can provide us holistic approach to analyze both specific as well as general contaminants	Some parasites are unable to detect the chemical change in the environment. Therefore, caution need to be taken while selecting a particular parasite group for contamination analysis.
Detection of minute changes due to concentration of chemicals in an environment is possible	Factors other than pollution can sometimes effect the biomonitoring potential of parasites

Parasites have many advantages over other commonly used biological indicators as well as modern scientific probes. The modern monitoring probes which are currently being used cannot detect the changes in food chain/food web and can only give rough estimate of the contamination level in an environment. The chemical analysis of environment is costly, complicated and time-consuming and as such, there has been search for quick and reliable analyzers.

The primary reason for using parasites as bio-sentinels is that they display complex interactions with surrounding environment at different life stages^{4,6,7}. There is an interaction among pathogens/parasites, hosts, and the environment, and the latter is least understood. It is worth mentioning here that parasitic disease can also occur without the above interaction. However, stressful condition increases the chances of disease occurrence. Besides, disease occurrence this interaction will also provide us additional information regarding the environmental status of an ecosystem.

In recent past parasite ecologists have advocated the usefulness of parasite organisms as warning sentinels or bio-indicator tools, nevertheless, some

may raise question whether to use parasites as bio-monitoring tools or not. Those believing on modern probes will argue that when there are tools/equipment's that are available for assessing pollution level at minute level, then why to use biological organisms for the same purpose.

Some ecologists suggest that there is need of holistic approach by integrating both modern as well as biological probes (including parasites) for investigating the pollution status of an ecosystem¹⁰. So under these circumstances, there is urgent need to find new biological probes which are efficient, easily available and more importantly linked in ecological web in such a way that it gives accurate information about different aspects. Parasites in this sense are unique and can prove useful biological indicators as they show many versatile features which are absent in many organism. Furthermore, the unsuitability of established biological indicators or sentinels under different ecological conditions and contamination types, makes parasites special in the sense that these can show even low contamination level in pristine conditions.

PARASITES AS PROMISING INDICATOR SPECIES

In past various organism have been preferred for the monitoring of ecosystem alterations. Some of these groups have shown good results and are being used by environmental managers in conjunction with modern probes to assess the environmental alterations (Fig. 2). The most preferred sentinels which has been selected in past are algae, mussels, crustacean, benthos and fish, have been tested in different environments with different contaminants. However, it has been established that some of these groups are not suitable for all contamination types, so there is an urge to find new sentinels which are applicable for all pollutants for monitoring purposes.

The graph shows that parasite is emerging as third major biological indicator group. **Note:** The analysis compares the number of citations retrieved after searching (Google Scholar; Years, 2000-2016) the research articles related to parasites with reference to pollution.

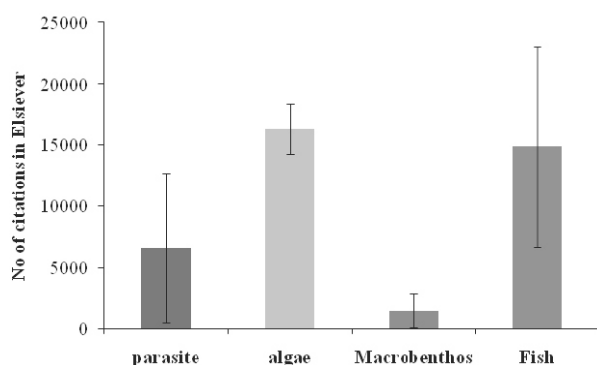


Fig. 2. Use of four major biological indicators for pollution assessment.

Various parasite groups meet most of the essential criteria which are ideal for biological probes (Box1). Parasites are more advanced in many ways due their uniqueness in an ecosystem. For example, these tiny creatures show different linkages in food web. It is essential to understand that groups/individual organisms which are more linked in ecosystem can give accurate status of environmental quality. However, it must be understood that all parasites have not the same capability of indicator quality because responsive nature of different groups of parasites is still debatable. Nevertheless, the potential of aquatic parasites, especially fish parasites to assess the environmental quality has been now fully understood, thanks to pioneering work of different environmental parasitologists.

Box 1 Criteria for ideal sentinels¹¹

High accumulation potential and the same correlation between pollutant content in the sentinel and the average pollutant concentration in the environment at all locations and under all conditions.

Not killed or rendered incapable of long-term reproduction by maximum possible levels of the pollutant in the environment. Sedentary or with a well-defined home range, so that findings relate to the area being studied

Large body, to provide sufficient tissue for analysis

Abundant species from which large numbers can be taken without altering the age structure or having some other significant effect on the population.

Box 1 Criteria for ideal sentinels¹¹

Widespread, to facilitate comparisons among different areas

Easy to collect and identify

Well-studied physiology, including the effects of age, size, season and reproductive activity on the assimilation of the pollutant activity on the assimilation of the pollutant.

Easily aged and long-lived, allowing integration of the pollutant over long periods

Parasites are most abundant creatures on earth as they are found in almost every ecosystem partly due to their high diversity and abundance¹². Parasites, which were traditionally looked as infecting agents, are now seen in never aspects, whether it is their role in ecosystem, their role in the regulation of host abundance or as a pollution indicator. Parasites of fish are useful biomarkers and appear to be more sensitive to environmental stressors than are the fish themselves. The possible reason could be that they are more numerous, have impact in ecosystem dynamics and show trophic relationships. Parasite responses to selected environmental stressors may be used to discriminate polluted and unpolluted sites. The use of parasites of fish as biomarkers has relevant application to fisheries management and coastal monitoring programs^{6,10}.

INDIAN SCENARIO

Different analytical procedures have been used in India for impact assessment analysis. In the past, environmental agencies in India have mostly relied on either chemical analysis or on the traditional biomonitoring organism. In recent years focus have shifted towards new emerging biomonitoring tools. For example, parasites of fish have been successfully used in lakes of North West Himalayan region (Kashmir Himalaya) for the assessment of water quality. Researchers from Kashmir have shown that helminth parasites are sensitive indicators of enhanced eutrophication and provide important information about the health status of aquatic ecosystem¹³⁻¹⁵. It has been established that both component community as well as infra community structure provides important information about the

deteriorating water quality. The monogenean gill parasite of fresh water fish in lake water bodies of Kashmir has revealed both synergistic as well as antagonistic effect of multiple pollutants. Apart from North West Himalayan region, there has been scanty contribution on behalf of researchers that has been carried out to assess the role parasite in the environment impact studies. In future environmental managers in India need to focus on following area:

Inclusion of aquatic parasites in the impact assessment programmes carried out in different parts of India

Parasites can be useful environmental indicators in coastal ecosystems as it has been already proven in the west that they have potential to assess the environmental quality

These tiny sensitive probes can be integrated with other indicator systems to provide better and robust sentinel system

There is need for enhanced study on the use of parasites as effect indicators in both lotic as well as lentic water systems to further understand their role as holistic indicators.

WHAT ARE CHALLENGES AHEAD?

Based on past research and current progress, it can be safely said that parasites have emerged as an alternative for determination of environmental quality. However, there are various issues which hamper ecologists to suggest parasite impact assessment analysis. The lack of some parasite groups to respond to specific contaminants poses problem while selecting these sentinels. Similarly, some groups of parasites are less sensitive under multiple stress conditions and as such can give wrong information about the status of environment. Nevertheless, such issues are not found every parasite species. Therefore, researchers need to be cautious while selecting a particular parasite group for environmental assessment and better way is to test all its advantageous features proposed by ecologist for the selection of an ideal indicator.

Selection of inappropriate methodology and model is another hurdle which at times can give false

results. As parasites are over dispersed, researchers need to select proper sample size for various environmental studies. It is also important that indicator potential of same parasite should be test in a series of battery of host species in order to reach to final conclusion. Study design in the field also need be redesigned according to type of contaminant and availability of host and their parasite.

Use of integrated approach-in which multiple indicators and biomarkers are complemented together- is the best way to unravel the real capacity of parasites as environmental indicators. For example, use biochemical, physiological and immunological biomarkers of both host and parasite can act as best model for measurement of environmental quality. In addition multiple groups of organisms have been suggested by various agencies to be included in biomonitoring programme. It is primarily due to the fact that individual organisms are less suitable for biomonitoring under multiple stress conditions and therefore there is need for indicator system which is cost effective and suitable for various ecosystems.

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PRECISION DAIRY FARMING

Moneesh Thakur¹ and Radhika Thakur²

Precision dairy farming is inherently an interdisciplinary field incorporating concepts of informatics, biostatistics, ethology, economics, animal breeding, animal husbandry, animal nutrition and process engineering. The main objectives of precision dairy farming includes, maximizing individual animal potential, early detection of disease and minimizing the use of medication through preventive health measures.

INTRODUCTION

India is the world's largest producer of milk, contributing 17% of world's milk production. Milk production in India is growing rapidly than world at 4% per annum. In national economy and social development dairying plays a very important role in our country. Traditionally, it is a business of rural households and small farmers characterized by small scale production with few animals. But, since liberalization of the dairy sector, a very large number of private sector companies/firms have established dairy farms in the country. Industrial production in dairy industry is rapidly moving forward. Across the globe, the trend toward fewer, larger dairy operations continues. Adequate dairy management and proper animal husbandry practices viz. early detection of disease, early and accurate heat detection, pregnancy diagnosis etc., are must to maintain profitability in these larger dairy farms. One can improve the quality of management practices by using newer technologies.

Technological progress in all facets of dairy farming, including genetics, nutrition, reproduction, disease control, and management can change the way in which dairy operations are managed. In this context "precision dairy farming may prove to be the

next important technological breakthrough for the dairy industry. In general, Precision Dairy Farming is the use of technologies to measure physiological, behavioral, and production indicators on individual animals to improve management strategies and farm performance. Many precision dairy farming technologies, including dairy milk yield recording, milk component monitoring, pedometers, automatic temperature recording devices, milk conductivity indicator, automatic estrus detection monitors, and daily body weight measurements, are already being utilized by dairy producers in several developed countries. As dairy operations continue to increase in size, precision technologies become more feasible because of increased reliance on unskilled labor and the ability to take advantage of economies of size related to technology adoption. Technologies for physiological monitoring of dairy cows have great potential to supplement the observations of skilled herd persons, which is especially critical as more cows are managed by fewer skilled workers. Further, the PDF technology has great impact on productive and economic performance of dairy animals.

PRECISION DAIRY FARMING

Precision Dairy Farming can be defined as "the use of information technologies for assessment of fine-scale animal and physical resource variability aimed at improved management strategies for optimizing economic, social, and environmental farm performance". It emphasize on technologies for individual animal monitoring, aims for an ecologically and economically sustainable

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production in milk with secured quality, as well as a high degree of consumer and animal protection. With precision dairy farming, the trend toward group management (which in general followed in large farms) may be reversed with focus returning to individual cows through the use of technologies. Technologies included within precision dairy farming range in complexity from daily milk yield recording to measurement of specific attributes (e.g. fat content or progesterone) within milk at each milking¹.

THE MAIN OBJECTIVES OF PRECISION DAIRY FARMING

Maximizing individual animal potential.

Detecting diseases earlier – reduces cost incurred to the farm and increases the length of animal's lives.

Minimizing the use of medication through preventive health measures.

Supplements observation activities of skilled herd persons – which are especially critical as more cows are managed by fewer skilled workers.

Optimize economic, social and environmental farm performance.

Make timely important decisions results in better productivity and profitability.

GOALS OF PRECISION DAIRY FARMING

Precision dairy farming supports societal goals: food of high quality and general safety, animal farming that is efficient but also sustainable, healthy animals and well being of animals and a low footprint of livestock production to the environment². The regulatory and societal requirements to livestock farming are of growing complexity. This results in larger organizations and the use of complex machinery and IT systems.

ECONOMIC LIVESTOCK FARMING

Due to academic studies, the requirements of an animal are well known for each phase of its life and individual physical demands. These requirements allow the precise preparation of an optimal feed to support the animal. The requirements are oriented on

the required nutrition providing more nutrition than required make no economic sense, but providing less nutrients can be negative to the health of the animal. The goal of precision dairy farming is to provide a mixture or ration that satisfies the animal's requirements at the lowest possible cost³.

QUALITY AND SAFETY

Economic goals are an important factor in livestock farming, but not the only one. Legal bodies (such as the government and industrial bodies) set quality standards that are legally binding to any livestock producing company. In addition, societal standards are followed⁴.

Quality is defined by the following characteristics:

The quality of used ingredients

The quality of animal keeping

The quality of the processes

One example for issues with quality of ingredients is the (nowadays often illegal) use of meat and bone meal for ruminant animals.

ECOLOGICAL LIVESTOCK FARMING

Selecting the 'right' ingredients can have a positive effect on the environment pollution. It has been shown that optimizing the feed this can reduce nitrogen and phosphorus found in the excrements of pigs⁵.

COMPONENTS OF PRECISION DAIRY FARMING

Computers.

Global Positioning System (GPS).

Geographic Information System (GIS).

Remote Sensing (RS).

Application control.

LIST OF CURRENTLY USED TECHNOLOGIES UNDER PRECISION DAIRY FARMING

The list of precision dairy farming technologies used for animal status monitoring and management continues to grow. Some of the commonly used precision dairies farming technologies, which are already being utilized by dairy producers, are as below:

Electronic identification systems and associated management software.

Precision Feeding systems.

Electronic rumen bolus: automatically record rumen temperature, pressure and Ph.

Robotic milking systems: daily milk yield recording, milk component monitoring (such as fat, protein and SCC), daily body weight measurements.

Robotic calf-feeding systems.

Pedometers / activity monitoring systems for heat detection.

Lameness detection and health monitoring systems.

Milk conductivity indicators.

Other theoretical precision dairy farming technologies have been proposed to measure jaw movements, ruminal pH, reticular contractions, heart rate, respiration rate, animal positioning and activity (where low activity may indicate a sick cow), vaginal mucus electrical resistance, feeding & lying behavior, odour, acoustics, glucose, progesterone, individual milk components and colour of milk. Further, in future the remote sensing of cow condition, GPS based cow tracking, and fenceless farms may be included in the suite of commercially available precision dairying technologies.

POTENTIAL BENEFITS OF PRECISION DAIRY FARMING

Benefits of precision dairy farming technologies include increased efficiency, through large-scale mechanization and economies of scale, reduced costs, improved quality and food safety through better animal identification and traceability, minimized environmental impacts, improved animal health and well-being through improved health and well-being through improved health monitoring and individual care. These technologies are likely to have the greatest impact in the areas of health, reproduction and quality control.

Traditionally, dairy producers have used experience and judgement to identify animals needing attention. But now real time data can be used

for monitoring animals and creating exception reports to identify animals or situations needing attention. While this skill is invaluable and can never be fully replaced with automated technologies, the powers of human perception are limited. Often, by the time an animal exhibits clinical signs of stress or illness, it is too late for effective treatment. These clinical symptoms are typically preceded by physiological responses not seen by the human eye (for example, changes in temperature or heart rate). Thus, by identifying changes in physiological parameters, a dairy manager may be able to intervene sooner.

LIMITATIONS OF PRECISION DAIRY FARMING

Slow Adoption Rate: Due to uncertain return on investment, high fixed costs of investment and information acquisition, and lack of demonstrated effects of these technologies on yields, input-use, and environmental performance.

Very Expensive: Due to lack of validated research results concerning the effects of application, high capital input and high costs.

Information obtained from precision dairy farming technologies is only useful if interpreted and used effectively in decision making. Animal ID read errors.

Equipment Failure: Often they are sophisticated to handle, low temporal resolution, and require good visibility of the subjects.

Data Transfer Error: Over-supply of data and time-consuming handling of software programme. Applicable to a restricted spatial area.

CONCLUSION

Precision dairy farming may prove new golden era of dairy industry. These technologies provide tremendous opportunities for improvements in individual animal management on dairy farms. Combined, all devices will provide data that measures cow comfort, which can then be extrapolated to make changes in the dairy's facilities. Cow comfort can lead to better overall health, which

lowers the cost of animal care or treatment and can increase animal longevity and boost milk yield. As labour costs increase, precision management tools that increase the labour efficiency of farms will continue gain in importance and popularity.

Precision dairy farming in developing countries including India is in its infancy but there are numerous opportunities for adoption. It must be remembered that not all elements of precision farming are relevant for each and every farm.

Likewise, not all farms are suitable to implement precision farming. Some farms are likely to adopt it partially, adopting certain elements but not others. Progressive farmers, with guidance from the public and private sectors, may adopt it in a limited scale as the technology shows potential for raising yields and economic returns. Its adoption would be improved if

it can be shown to reduce the risk. Effective coordination among the public and private sectors and growers is, therefore, essential for implementing new strategies to achieve fruitful success.

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METABOLIC SYNDROME – QUEST FOR NOVEL HERBAL DRUG

Mohan Chandra Kalita, Jayashree Dutta* and Rantumoni Sharma

Metabolic syndrome often termed as insulin – resistant or cardiac metabolite syndrome is one type of non communicable disease. The disease is spreading rapidly world wide due to increasing unhealthy lifestyle habits. Though several synthenetic drugs are available for treatment of metabolic syndrome, the search for plant based is highly encouraged now a days due to their minimum side effects and high efficacy. Apart from that, few small changes in our day to day habits can help us to combat with deadly metabolic syndrome to a huge extent.

INTRODUCTION

Metabolic syndrome, commonly known as “Syndrome X”, is defined as a group of conditions or a factor that increases the risk of increased blood sugar level, increased blood pressure, excess body fat around the waist, and abnormal cholesterol or triglyceride levels that occur together, and finally results in heart disease, stroke and diabetes¹. Most of the disorders associated with metabolic syndrome have no definite symptoms.

According to guidelines by the National Institutes of Health, clinically metabolic syndrome occurs in a person who has three or more of the following measurements:

Abdominal obesity (Waist circumference of 40 inches or above in men, and 35 inches or above in women)

Triglyceride level of 150 milligrams per deciliter of blood (mg/dL) or greater

HDL cholesterol of less than 40 mg/dL in men or less than 50 mg/dL in women

Systolic blood pressure (top number) of 130 millimeters of mercury (mm Hg) or greater, or diastolic blood pressure (bottom number) of 85 mm Hg or greater

Fasting glucose of 100 mg/dL or greater

Metabolic syndrome being a serious health condition is affecting a wide range of population throughout the world. The main drivers are related to rapid nutritional changes, lifestyle and socioeconomic transitions, consequent to increasing affluence, urbanization, mechanization, and rural-to-urban migration. World Health Organization (WHO), predicted that diabetes incidence will double (affects more than 70 million individuals) by 2025, also indicates a parallel rise in cardiovascular-related illness and death, with an inevitable and profound impact on the global healthcare system^{2,3}.

India is experiencing a rapid increase in the prevalence of obesity, type 2-diabetes and deaths from cardiovascular disease (CVD). In recent years, it is being projected that in the near future, India will have the largest number of cardiovascular disease and diabetes burden in the world³.

AVAILABLE TREATMENT STRATEGIES FOR METABOLIC SYNDROME

The aim for future management of diagnosis of the metabolic syndrome should be aggressive and uncompromising to reduce the risk of CVD and type 2 diabetes. A full cardiovascular risk assessment, including smoking status should be done with patients in conjunction with precautions.

For the first line treatment strategy of metabolic syndrome, it is important to manage the underlying

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risk factors that promote the development of metabolic syndrome. The implementation of lifestyle interventions remains the cornerstone of management, with intensive dietary modification and increased physical activity. Drug therapies are also recommended by following lifestyle modification in patients with a CVD risk.

Several drugs are available for treatment of cardiometabolic risk reduction. It includes antihyperglycemic, antihypertensives, and cholesterol-lowering agents such as metformin, Angiotensin II Receptor Blockers, ACE inhibitors and statins respectively⁴. Currently, in addition to the above said drugs, two drugs-sibutramine and rimonabant-have been evaluated and produced good outcomes in the overall management of high-risk patients with metabolic syndrome. Unfortunately, most of this synthetic drugs comes out with severe side effects like gaining weight, vomiting, Nausea, hypoglycemia, uneasiness etc.

HERBAL INCLINATION TOWARDS MANAGEMENT OF METABOLIC SYNDROME

During the last few years, there have been a continuous research in the field of metabolic syndrome for development of new plant based therapeutic targets or noble leads that are specific on their action and comes with a minimum or no side effects. In due course of time, several plants derived compounds have demonstrated potent activity against metabolic syndrome. Among all phytoconstituents, flavonoid have gained fair share of recognition in controlling metabolic syndrome. Many preclinical and clinical investigations of this compound had lead to the emergence in amelioration of insulin resistance, hypertriglyceridemia, hypercholesterolemia, obesity, and hypertension. Many plants derived secondary metabolites like polyphenols and flavonoids, have the potentiality to act against metabolic syndrome. Such active compounds are present in our daily dietary plants that are often consumed by us such as cereals, legumes, fruits, tea, olive oil and dark chocolate that contribute towards beneficial health effects against metabolic syndrome.

North East India, better known as 'Mega Biodiversity Hotspot' for its rich biodiversity of flora that covers approximately 50% of the total Indian flora. N.E region harbors many ethnic groups and tribes. Many of this ethnic tribes of North East India, particularly those from villages situated in remote areas, have an indigenous traditional based knowledge in health care⁵. This knowledge was adopted from their forefathers in form of culture are widely used by healers in this part of India to treat several ailment including metabolic syndrome diabetes mellitus, hyperlipidemia, hypertension and obesity. The rural population of N.E India uses several culinary Plants like *Allium cepa L*, *Azadirachta indica*, *Catharanthus roseus*, *Swertia chirata*, *Trigonella foenum graceum*, *Pterocarpus marsupium*, *Momordica charantia*, *Eugenia jambolan*, *Gymnema sylvestre* and *Cinnamomum zeylanicum* in their day to day diet. Such plants are reported to rank highest in potential antidiabetic activity⁶. Besides, plants like *Allium sativum*, *Cinnamomum tamala*, *Garcinia pedunculata*, *Terminalia arjuna*, *Coriandrum sativum L.*, *Emblica officinalis*, *Phyllanthus niruri*, *Glycine max (L)*, *Ocimum sanctum*, *Moringa oleifera*, *Sesamum indicum*, *Curcuma longa*, *Withania somnifera* and *Citrus sinensis* are scientifically validated and scrutinized for possessing very high anti cholesterol and anti hyperlipidemia property by several research⁷.

Investigation is needed to determine the metabolic factors responsible for disease and cut offs should be used to identify children and adolescents who are at much risk towards metabolic syndrome. India is rapidly becoming a country with a triple burden of obesity; hence early prevention and intervention are needed^{8,9}. Neglecting this issue will lead to compromise the future of cardio metabolic health problems among the population of India and may result into a serious public health crisis. Hence, awareness programs about weight management, healthy diet, yoga, physical exercise and regular health check-ups should be made among the urban as well as rural population in order to control the risk factors in people as early as possible.

A GLIMPSE OF PLANT DERIVED DRUG CURRENTLY AVAILABLE IN INDIAN MARKET FOR MANAGEMENT OF METABOLIC SYNDROME

Many plants derived drugs are now a days available in the market for treatment of metabolic syndrome and its associated complications. Plant derived phytoconstituents are being accepted by people because of their minimum side effects and herbal origin. Among such drug, metformin obtained from *Gelega officinalis*, is one which is considered to be a potent antidiabetic drug, which is even considered safe for children having diabetes mellitus. Research for plant derived drug having minimum side effects is extensively carried out throughout the country. A recent development is drug 'IME-9' developed by the Ministry of Ayush, Govt. of India that is considered to be significantly effective against diabetes mellitus. The drug works in a synergistic combination of five vital herbs viz. *Momordica charantia*, *Eugenia jambola*, *Spondias mombin*, Gudmur, and *Asphaltum*. 'IME -9' ought to prevent complications associated with metabolic syndrome like heart disease, high blood pressure, high cholesterol and high blood sugar. Another important drug plant derived drug 'BGR- 34' has also been launched in Indian market by National Botanical Institute (NBRI) and Central Institute for Medicinal and Aromatic Plant CIMAP, Lucknow) to fight with metabolic syndrome.

HEALTHY TIPS IN DAILY LIFE TO COMBAT INCREASING RISK OF METABOLIC SYNDROME

People need to change their habits in the direction of healthier living. It is possible to keep these diseases under control, if we make sensible alteration in our day to day activities. We can follow some healthy tips in daily life to minimize the risk of lifestyle disease to a greater extent such as:

Exercising regularly like walking and cycling. 150 minutes per week moderately intense exercise can minimize the chances of CVD to a great extent.

Maximize the use of stair-case instead of lift or escalator.

Eating healthy living foods like wholesome grains, fresh vegetables and seasonal fruits.

Avoid dead food like processed and packaged foods that are rich in fats, sugar and salt such as chips, fries, soft drink and fast foods. Being high in fat and calories, they are the leading cause of obesity, CVD and type II diabetes.

Limit consumption of sugar and sugar-based beverages. Sugar (free sugars refined from sugarcane or sugar beets and high-fructose corn sweeteners) has no nutritional value except for calories and, thus, has negative health implications for those at risk of overweight.

Limit sodium intake, since it is the principle component contributing for high blood pressure that is a major risk factor for stroke and coronary disease.

Avoid stress in life by practicing yoga or meditation. Give time to your family and friends since it is the greatest predictor of our longevity.

Stay away from smoking and drinking alcohol. Maximum lung and liver diseases are caused due to smoking and drinking alcohol respectively.

7-8 hours sleep is necessary for an adult for proper body metabolism. Insufficient sleep or insomnia is associated with CVD, diabetes, hypertension, obesity and depression.

Recently, WHO recommends (The Hindu, Oct. 16, 2016) to impose sugar tax and pointed out that at least 20 per cent increase in the retail prices of sugary drinks would result in proportional reductions in consumption of such products. This initiative definitely will reduce the sufferings from overweight, obesity, hypertension, diabetes and many other life style related metabolic diseases. Even, the government may enact law or go for certain steps to ban such nutrient deficient sugar and its products, keeping in view to the overall health benefits of public. An observation by R M Anjana. Director, Madras Diabetic Research Foundation was that "the consumption of sugary drinks is a major

problem in children and this is easily linked to obesity and diabetes.

We can in fact nurture nature; our genes are not our destiny. Chronic diseases are not only the consequences of our healthcare crisis but our lifestyle choices too are!!

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KNOW THY INSTITUTIONS

**INDIAN INSTITUTE OF VEGETABLE RESEARCH, VARANASI**

Indian Institute of Vegetable Research - [IIVR], Varanasi, Uttar Pradesh is research center on vegetables in Uttar Pradesh. Earlier, vegetable research was not given much importance. However, with the establishment of AICRP on vegetable crops during the year 1971 at IARI, New Delhi, the area started getting impetus. The responsibilities like coordinating; monitoring vegetable research programs and others of the country was handled by the body. The objective was give boost to the research activities in the country. Further, the body helped met challenges of nutritional security along with status of AICRP on vegetable crops. The body was elevated to the distinction of Project Directorate of Vegetable Research in the year 1986. The headquarters of the same were at IARI, New Delhi. However, during the year 1992, the headquarters were shifted to Varanasi from New Delhi. The institute was further elevated to Indian Institute of Vegetable Research - [IIVR] by offering the status of national institute under ICAR system in the year 1999.

Vegetable Research Farm –Spread over 150

acres of land, the farm undertakes several research projects across disciplines. There are three submersible tube wells, underground irrigation systems, drip irrigation, sprinkler irrigation and also water harvesting tank facilities at the farm. The purpose is to research facilities to conduct field experiments.

State of the Art Laboratory for Research–The institute has built advanced laboratory complex to conduct researches on several disciplines of vegetable science. With 24 laboratories in the campus, the institute has ensured that every laboratory is equipped with contemporary electric equipment for crop improvement, crop production, crop protection, seed technology, seed health, economics and others. The institute has also ensured facilities for information, coordinated research units and social sciences.

Supportive facilities –The institute even has well-stocked library, gene bank, greenhouses, poly houses, seed processing unit, agricultural knowledge management unit, centre of excellence for training and auditoriums.

Mandate

To undertake innovative, basic, strategic and applied research for developing technologies to enhance productivity of vegetable crops, their nutrient quality, post harvest management and value addition.

To provide scientific leadership in coordinated network research for solving location specific problems of production and to monitor breeder seed production of released / notified varieties.

To act as a national repository of scientific information relevant to vegetable crops and as a centre for training for up-gradation of scientific manpower working on vegetable crops.

To develop high yielding, good quality, disease and pest resistant varieties/hybrids of selected vegetable crops.

To develop advanced production and protection technologies for selected vegetable varieties / hybrids.

To undertake germplasm collection, maintenance and documentation in vegetable crops.

To improve the compilation of data and analysis by provision of micro processing facilities especially of regional trials undertaken in coordinated research project and network schemes.

To provide technical supervision for the breeder seed production of released varieties and parental lines of vegetable crops.

AICRP on Vegetable Crops- The Largest Network in Vegetable Research

All India Coordinated Research Project (AICRP) on vegetable crops (VC) was started during the IVth five-year plan in 1970-71, to provide a national grid for multi-location testing of the vegetable technologies developed by various research institutes and state agricultural universities. The headquarter of the project was at the Division of Vegetable Crops, Indian Agricultural Research Institute (IARI), New Delhi and the Project Coordinator (Vegetable Crops) joined the project in July 1971. During 1986, level of the project was

elevated to the Project Directorate. Further, in a significant development during 1992, headquarter of the directorate was shifted from IARI, New Delhi to the present day Indian Institute of Vegetable Research (IIVR) at Varanasi. In a significant development, in eleventh five-year plan the NSP(Vegetables) was merged with AICRP(VC).

Presently the AICRP Vegetable Crops is a network of 36 regular and 18 voluntary centres. The network is headed by the Project Coordinator and its headquarter functions from IIVR main campus. The AICRP centers are located in different agro-climatic zones of the country. The centers in the network include ICAR institutes, central institutes, state agricultural and traditional universities and a few other public and private research organizations. The main function of AICRP-VC is to provide a national level platform for multi-location testing of the vegetable technologies developed by various research institutes and state agricultural universities to identify region specific recommendations.

Agricultural Technology Information Centre (ATIC)

Agricultural Technology Information Center (ATIC) at Indian Institute of Vegetable Research, Varanasi started functioning in 2005 as a single window service system with an objective to help the farmers and other stakeholders by providing technical guidance in vegetable production and protection along with Institutes activities & achievements, publications, quality vegetable seeds and other farm products for their testing and use. The main activities are :

Providing improved quality vegetable seeds (breeder & TL), publications and other farm products developed/produced in the Institute.

Organize need based sponsored training programme for farmers, officials and other stakeholders on various aspects of vegetable improvement, production, protection and social empowerment.

Provide technical guidance in vegetable production and protection to the visitors along with one-day exposure visit of the farmers sponsored by different organizations.

Conduct Extension Experiments in Uttar Pradesh, Bihar and adjoining area for rapid dissemination of improved technologies in vegetable crops among farmers and other stakeholders.

Monitor the activities of three KVKs at Kushinagar, Deoria and Sant Ravidas Nagar districts functioning under the administrative control of IIVR.

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CONFERENCES / MEETINGS / SYMPOSIA / SEMINARS

2nd International Conference on Environment, Chemical Engineering & Materials, (ECEM '18) - Malta, June 2-4, 2018.

Contact :

Dr. Elena Roman, E-mail: ecem.conf@gmail.com, website: <http://www.ecem-conf.org/>

3rd International Conference on Materials Engineering and Nanotechnology ICMEN 2018, July 19-21, 2018, Tokyo, Japan.

Topics:

Materials Engineering

Advanced Characterization
Biological Materials
Biotechnology and Life Sciences
Bulk Crystal Growth
Characterization
Computational Materials Science
Corrosion and Environmental Effects
Defects
Devices
Economics of Materials
Electrochemistry
Electronic Materials
Electronic, Optical, and Magnetic Properties
Energy and Environmental Technology
Information and Telecommunications
Technology
Magnetic Materials
Magnetic Properties

Manufacturing
Materials Culture
Materials for Energy and Environmental
Applications
Materials Processing
Materials Theory
Mechanical Behavior of Materials
Mechanical Properties and Nanomechanics
Nanopatterning
Nanotechnology
Optical and Photonic Materials
Optoelectronics
Organic Polymer Materials
Phase Transformations
Self Assembly
Shape Deposition Manufacturing
Surfaces, Interfaces, and Thin Films
Thin-Film Deposition
Transport Properties

Nanotechnology

Nanotechnology and Materials Sciences
Materials Science and Engineering
Nanotechnology
Advanced Applications in Nanoscience and
Nanotechnology
Carbon Nanotubes and Biomolecules
Nanomaterials
Nanoelectronics
Nanosystems
Nanomechanics
Nanomanipulation

Nanomagnetism
Nanooptics and Nanophotonics
Nanowires
Nanofluidics
Nanobiotechnology
Nanoscale Science and Technology
Molecular Electronics
Quantum Devices
Quantum Electrodynamics of Nanosystems
Scanning Probe Microscopy/Spectroscopy
and Related Instrumentation
Advances in Materials and Processing for
Nanotechnology and Nanofabrication

Contact :

Ms. Echo J. Nie , Conference Secretary of ICMEN, Email: icmen@zhconf.ac.cn ,Tel: +86-28-83533337,
Website: <http://www.icmen.org/>

Global Meeting on Diabetes and Endocrinology , July 25-26, 2018, Kuala Lumpur, Malaysia.

Topics:

Commitment to Excellence in the field of Diabetes and Endocrinology

Contact :

Anne Perry, **Email:** endocrinology2018@rediffmail.com **Website** <http://endocrinology.diabetesexpo.com>

Second International Conference on Biotechnology & Biological Sciences (BIOSPECTRUM 2018), 27th and 28th of July, 2018, Kolkata.

Topics:

BIOSPECTRUM, 2018 will bring forth a unique bridging forum for interaction among eminent academicians, scientists , researchers and professionals from various branches of biological sciences; a platform to exchange knowledge and expertise enriching researchers with opportunities of networking and collaboration across the globe. This conference will also promote an intense dialogue between academia and industry to bridge the gap between academic research, industry initiatives, and governmental policies and also this conference will bring forth the concept of Lab to industry.

Contact :

Prof. Dibyajit Lahiri, Assistant Professor, Department of Biotechnology, University of Engineering & Management, University Area, Plot No. III - B/5, New Town, Action Area - III, Kolkata, West Bengal 700160, Contact No.- 8017259210

7th International Conference on Innovations in Electronics & Communication Engineering ICIECE - 2018, 27th- 28th July, 2018, Gurunanak Institutions, Hyderabad, Telangana.

Topics:

Latest Developments and Research in the following fields:

Signal Processing

Signals & Systems
Digital Signal Processing
Video & Image Processing
Biomedical Electronics
Radar Signal Processing
Communication Codes
Speech Synthesis & Signal Processing

Communication

Digital Communication
Mobile Communication
Wireless Communication
Satellite Communication
Optical Communication
Spread Spectrum Communication
TV Engineering
Advanced Modulation Scheme
Networking

Antenna / Microwave

Antennas
Wave Propagation
MEMOs
Radars

VLSI

Low Power VLSI
VLSI Technology
MEMS
Bionano Technology

Cognitive Electronics

Mixed VLSI Design

Miscellaneous

Sensors
Mechatronics
Renewable Energy Sources
Nuclear Energy
Artificial Intelligence/Expert Systems
Navigational Electronics
NDT
Grid Computing
Photonics
Molecular Physics
Power Systems(Traction)
Electromagnetic Interference
Electromagnetic Compatibility

Embedded Systems

Real Time Systems
Embedded Processors
RTOS
Embedded Networking
Advanced Computer Architecture
Robotics
Assistive Technology
Machine to Machine Solutions
IoT(Internet of Things)
Applied Electronics

Contact :

Dr. K. Santhi (Convener) / Mr. Srinivas Nanda, Assistant Professor, Mobile No.:+91 772 999 3428,
Email : iciece2018@gmail.com

5th International Conference on Geological and Environmental Sustainability, August 13-14, 2018, Bali, Indonesia.

Topics:

An Insight into Solid Earth & Soil materials for futuristic advancements

Contact :

Grace Kelly, Email: geology@earthscienceconferences.com Website <http://geology.conferenceseries.com>

1st International Conference on Wireless Sensor Networks, Ubiquitous Computing and Applications 2018 ICWSNUCA-2018, 24th - 25th August 2018, Hyderabad.

Topics:

Track 1: WSN Applications and Computing

Wireless Sensor Networks
Applications of Mobile Ad hoc Networks (MANETs)
Hybrid Networks
Applications of IoT through Sensors
Smart Homes and Smart Grid technology
Wearable computing
Cloud Computing through Sensors
Renewable power resources for wireless devices
Vehicle tracking system
Location and Context Aware Computing
Smart Surveillance
Device to Device Communications
Computing in Hand held devices
Communicating Infrastructure in WSN

Data management in Wireless Sensor Networks

Applications of Neural Networks and Fuzzy Logic in WSN

4G / 5G Technologies

Track 2 :Security Issues in Developing Algorithms/ Protocols

Security in WSN

Security Issues in MANET

Intruder Detection System

Intrusion Prevention Mechanisms

Cyber Security

Development of QoS Algorithms/Protocols

Energy efficient Algorithms/ Protocols

Optimization Techniques

Encryption and Decryption Algorithms.

Security Issues in implementing IoT

Security in Digital Image Processing

Contact :

Convenor, Dr. Padmalaya Nayak– Professor, IT, Telephone:+918297356416, E-mail:padmalaya@griet.ac.in

Materials & Technologies for Energy Conversion and Storage (M-TECS 2018), September 26-29, 2018, Anushaktinagar, Mumbai.

Topics:

Solar Energy Materials

Thermoelectric Materials

Alternate Energy Sources (Nuclear, Fuel cell, Wind, Tidal, Hydrogen, Water splitting etc.)

Energy Storage Materials and Devices

Single Crystal, Sensor, and Transducer

Instrumentation

Contact :

Dr. A.K. Chauhan, Technical Physics Division, Bhabha Atomic Research Centre, Mumbai-400085, Tel : +91 22 25593911 ,Email:akc.barc@gmail.com, <http://www.mtecs.co>

S & T ACROSS THE WORLD

WHEAT DISEASE BREAKTHROUGH TO HELP FEED THE WORLD

Scientists have isolated the very first rust pathogen gene that wheat plants detect to 'switch on' resistance. Famine may be largely a thing of the past but in recent years the re-emergence of a disease that can kill wheat -- which provides a fifth of humanity's food -- has threatened food security; now a breakthrough is being announced just before Christmas, in two companion papers being published in *Science* 2017; 358 (6370):.

In a world first, science has leaped a step ahead of an old foe that has recently re-emerged in some parts of the world, where it has devastated crops because of its ability to evolve, undoing much of the hard work that began in earnest with the Green Revolution -- using natural techniques to isolate the first rust pathogen gene that wheat plants detect and use to 'switch on' in-built resistance.

The breakthrough in research targeting the stem rust foe -- historically the most dangerous pathogen of wheat -- will mean suspect samples could be analysed within hours in an emergency rather than weeks, potentially saving crops from being destroyed.

"For the first time it will be possible to do DNA testing to identify whether a rust in a wheat crop anywhere in the world can overcome a rust-resistance gene, called Sr50, which is being introduced in high-yielding wheat varieties," said Professor Robert Park, corresponding author from the University of Sydney.

"This will indicate whether or not a given wheat crop needs to be sprayed with expensive fungicide quickly to protect against rust -- which would otherwise devastate the crop in a matter of weeks."

Rust disease epidemics have emerged at times in tandem with carefully refined selective breeding in cereals; the disease is once again extremely damaging in East Africa and is making a comeback in Europe.

Mr Jiapeng Chen, a PhD candidate from the University of Sydney who initiated the work by sequencing and analysing the genome of a virulent rust isolate, said this was the first important step in addressing the diagnostic challenges posed by ever-changing fungi, which result in new rust pathogen strains.

Professor Park explained: "It's like an ongoing arms race -- we've got to keep one step ahead of this changing pathogen.

"The last major epidemic of wheat stem rust in Australia alone, in 1973, caused \$AU300 million in damage -- imagine what that would be today."

Co-corresponding author, Dr Peter Dodds from the Commonwealth Scientific Industrial Research Organisation, said demand for wheat in the developing world was expected to jump 60 percent by 2050 and in economic terms alone the ramifications were huge.

"Now that we've identified how stem rust strains are able to overcome Sr50 resistance -- by mutation of a gene we've identified called AvrSr50 -- this information can be used to help prioritise resistance genes for deployment.

"Our results so far show the plant immune system is able directly to recognise the fungal protein, said Dr Peter Dodds, from CSIRO's Agriculture and Food team. "We are gaining a better understanding of the whole process -- what's going on at the protein level, at the gene level."

Co-author Dr Kostya Kanyuka from Rothamsted Research, an agricultural science centre in the United Kingdom, said stem rust had been making a comeback in Europe, for example in Sweden as recently as this year, and was threatening Asia and the US.

"The highly virulent Ug99 race of the stem rust fungus -- which emerged in 1998 in Uganda -- has become even more potent as it has spread through Africa and the Middle East, with winds threatening to carry it into Asia," Dr Kanyuka said.

US collaborators Professor Melania Figueroa, Professor Brian Steffenson and Dr Yue Jin were able to extend the results of the study by examining strains

of the stem rust pathogen from other parts of the world, including the US and Africa.

"It is important to look at this gene in worldwide rust strains to gain a picture of where virulence is most likely to evolve," Professor Figueroa said.

Professor Park, from the Plant Breeding Institute, part of the University's Sydney Institute of Agriculture and School of Life and Environmental Sciences, said the results should also lead to a better understanding of how rust pathogens infect wheat, evading detection by the wheat plant, and causing yield losses.

"In addition to the immediate practical benefit regarding the important rust-resistance gene Sr50, our world-first finding could potentially have a longer-term payoff in the 10-15-year horizon," he said.

(Source: <https://www.sciencedaily.com/releases/2017/12/171221143050.htm>)

USING DNA STRANDS TO DESIGN NEW POLYMER MATERIALS

Novel particles could be used in applications ranging from drug delivery to 'soft robotics'

McGill University researchers have chemically imprinted polymer particles with DNA strands -- a technique that could lead to new materials for applications ranging from biomedicine to the promising field of "soft robotics."

In a study published in *Nature Chemistry*, 2013; 5 (10): 868 the researchers describe a method to create asymmetrical polymer particles that bind together in a spatially defined manner, the way that atoms come together to make molecules.

Although polymers are used in everything from clothing and food packaging to 3D printing and electronics, most self-assembled polymer structures have been limited to symmetrical forms such as spherical or cylindrical shapes. Recently, however, scientists have focused on creating non-symmetrical polymer structures -- for example 'Janus' particles with two different 'faces' -- and they are starting to discover exciting new applications for these

materials. One example: robotics made with soft, flexible structures that can change shape in response to external stimuli.

The method described in the *Nature Chemistry* paper "introduces a programmable level of organization that is currently difficult to attain in polymer chemistry," says McGill Chemistry professor Hanadi Sleiman, senior author of the study. "Chemically copying the information contained in DNA nanostructures offers a powerful solution to the problem of size, shape and directional control for polymeric materials."

The new study builds on a technique developed in 2013 by Sleiman's research group to make nanoscale "cages" from strands of DNA, and stuff them with lipid-like polymer chains that fold together into a ball-shaped particle that can contain cargo such as drug molecules.

To take that nano-engineering feat a step further, Sleiman and her PhD student Tuan Trinh teamed up with colleagues at the University of Vermont and Texas A&M University at Qatar. Together, the researchers developed a method to imprint the polymer ball with DNA strands arranged in pre-designed orientations. The cages can then be undone, leaving behind DNA-imprinted polymer particles capable of self-assembling -- much like DNA, itself -- in pre-designed patterns. Because the DNA cages are used as a 'mold' to build the polymer particle, the particle size and number of molecular units in the polymer can be precisely controlled, says Sleiman, who holds the Canada Research Chair in DNA Nanoscience.

The asymmetrical polymer structures could be used eventually in a range of applications, the researchers say. One potential example: multi-compartment polymer particles, with each compartment encapsulating a different drug that could be delivered using different stimuli at different times. Another possibility: porous membranes that are asymmetric, so they direct molecules along specific paths to separate them.

(Source: <https://www.sciencedaily.com/releases/2017/12/171219133626.htm>)

THINNING ICE CREATES UNDER SEA ARCTIC GREENHOUSES

Sea ice skylights formed by warming Arctic temperatures increasingly allow enough sunlight into the waters below to spur phytoplankton blooms, new research suggests. Such conditions, probably a rarity more than two decades ago, now extend to roughly 30 percent of the ice-covered Arctic Ocean during July, researchers report March 29, 2017 in *Science Advances*.

The microscopic critters need plenty of sunlight to thrive, so scientists were stunned by the discovery of a sprawling bloom below the normally sun-blocking Arctic ice in July 2011. Satellites can't peek below the ice, though, so scientists at the time didn't know whether the bloom was an oddity or representative of a shift in the Arctic environment.

Harvard University oceanographer Christopher Horvat and colleagues created a computer simulation of sea ice conditions from 1986 through 2015. Warming temperatures have thinned the ice, the researchers found, and increased the prevalence of meltwater pools on top of the ice that allow more light to pass through than bare or snow-covered ice.

Whether blooms are in fact more commonplace under the ice remains unclear, though, because the study didn't consider whether there would be enough nutrients such as nitrogen and iron for budding blooms. If more blooms are lurking in the Arctic Ocean, they may already be dramatically reshaping the Arctic ecosystem. A boost in phytoplankton could alter marine food webs as well as soak up more planet-warming carbon dioxide from the environment.

(Source: <https://www.sciencenews.org> Magazine issue: Vol. 191 No. 8, April 29, 2017, p. 20)

THE KEY TO BREAKING DOWN PLASTIC MAY BE IN CATERPILLARS' GUTS

To destroy plastic, caterpillars go with their gut bacteria.

Caterpillars that nibble through polyethylene plastic cultivate a diverse community of digestive bacteria that process the plastic, researchers reported November 13 at the annual meeting of the Society of Environmental Toxicology and Chemistry North America. Dousing old plastic in a similar mix of bacteria might speed the breakdown of the persistent pollutant.

Polyethylene is widely used to make plastic bags and other packaging materials, but it hangs around in landfills for decades, perhaps even centuries. Recently, scientists identified several species of caterpillars that appear to eat and digest the plastic, breaking it down. But dumping old shopping bags into a den of caterpillars isn't really a practical large-scale strategy for getting rid of the plastic. So to figure out the insects' secret, researchers fed polyethylene to the larvae of pantry moths, *Plodia interpunctella*, and then looked at the bacteria in the caterpillars' guts.

Caterpillars that ate a control diet of bran and wheat had guts mostly dominated by *Turicibacter*, a group of bacteria commonly found in animals' digestive tracts. But the caterpillars that munched on the plastic had a much more diverse native microbial community. In particular, they had high levels of a few types of bacteria: *Tepidimonas*, *Pseudomonas*, Rhizobiales and Methylobacteriaceae.

Some of these bacteria have been shown to colonize and help degrade plastics in the ocean, says study coauthor Anisha Navlekar of Texas Tech University in Lubbock, so it makes sense that the microorganisms also appear to be helping the caterpillars break down plastics.

(Source: <https://www.sciencenews.org>/November 17, 2017)



THE INDIAN SCIENCE CONGRESS ASSOCIATION
14, DR. BIRESH GUHA STREET, KOLKATA-700017

ISCA YOUNG SCIENTIST AWARD PROGRAMME : 2018-2019

To encourage Young Scientists, The Indian Science Congress Association has instituted a number of awards in different disciplines. These awards carry a sum of Rs.25,000/- besides a Certificate of Merit.

1. Applications are invited from members (**Life & Annual**) of the Association who have paid their subscription on or before **July 15, 2018**. The upper age limit of the candidates for the award is 32 years as reckoned on **December 31, 2018 (born on and after January 01, 1987)**.
2. Four copies of the abstract (not exceeding 100 words) along with four copies of full length paper must reach the office of the General Secretary (Membership Affairs) not later than **August 16, 2018**. At the top of each copy of the paper and its abstract, the name of the Section under which the paper is to be considered should be indicated. For details of Sections see <http://www.sciencecongress.nic.in/html/paper/presentations.php>.
3. Along with the Four copies of paper, Four copies of the Application Form (to be downloaded from ISCA website (http://www.sciencecongress.nic.in/html/young_sc_programme.php) with brief bio-data of the candidate (not exceeding 2 pages), list of publications, with copies of reprints of already published papers if any and a soft copy of the duly filled application form with scanned copies of enclosures (excluding reprints), full length paper and abstract in **MS Word(not PDF)** along with bio data in the form of a CD must also be sent simultaneously along with the hard copies.
4. The Paper submitted must be a **single author paper** and the research work should have been carried out in India and this has to be certified by the Head of the Institution from where the candidate is applying.
5. The candidate should give an undertaking that the paper being submitted has not been published in any journal or presented in any other Conference / Seminar / Symposium or submitted for consideration of any award.
6. A Young Scientist can present only one paper in any one Section (and not a second paper on the same or any other topic in any other Section).
7. A person who has already received Young Scientist Award in any section once will not be eligible to apply for the above Award in the same or any other section.
8. Incomplete Applications will not be considered.
9. The papers submitted will be subjected to verification for authenticity.
10. Full length paper will be evaluated by experts and the selected Young Scientists (**maximum of six**) in each section will be invited to make oral presentation of their paper during 106th Indian Science Congress. The selected candidates will be provided admissible travelling allowances by ISCA.
11. The final selection for the Awards will be made by a duly constituted committee and the awards will be given during the Valedictory Session of 106th Indian Science Congress session to be held on January 7, 2019.
12. Applications submitted for the above award will not be returned.
13. The last date for receiving papers at ISCA Headquarters is **August 16, 2018**.

All correspondences should be made to: The General Secretary (Membership Affairs), The Indian Science Congress Association, 14, Dr. Biresw Guha St., Kolkata-700017. Tel. Nos. (033)2287-4530/ 2281 5323, Fax. no. 91-33-2287-2551, E-mail:iscacal@vsnl.net, website:<http://www.sciencecongress.nic.in>



भारतीय विज्ञान कांग्रेस संस्था

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सदस्यता की शर्तें और सदस्यों की विशेषाधिकार/Terms of Membership and Privileges of Members :

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 :

आधार नंबर (अनिवार्य) / Aadhaar Number (Mandatory) :

स्थायी पता/Permanent Address :

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 विधिकत 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.