# Science Horizon

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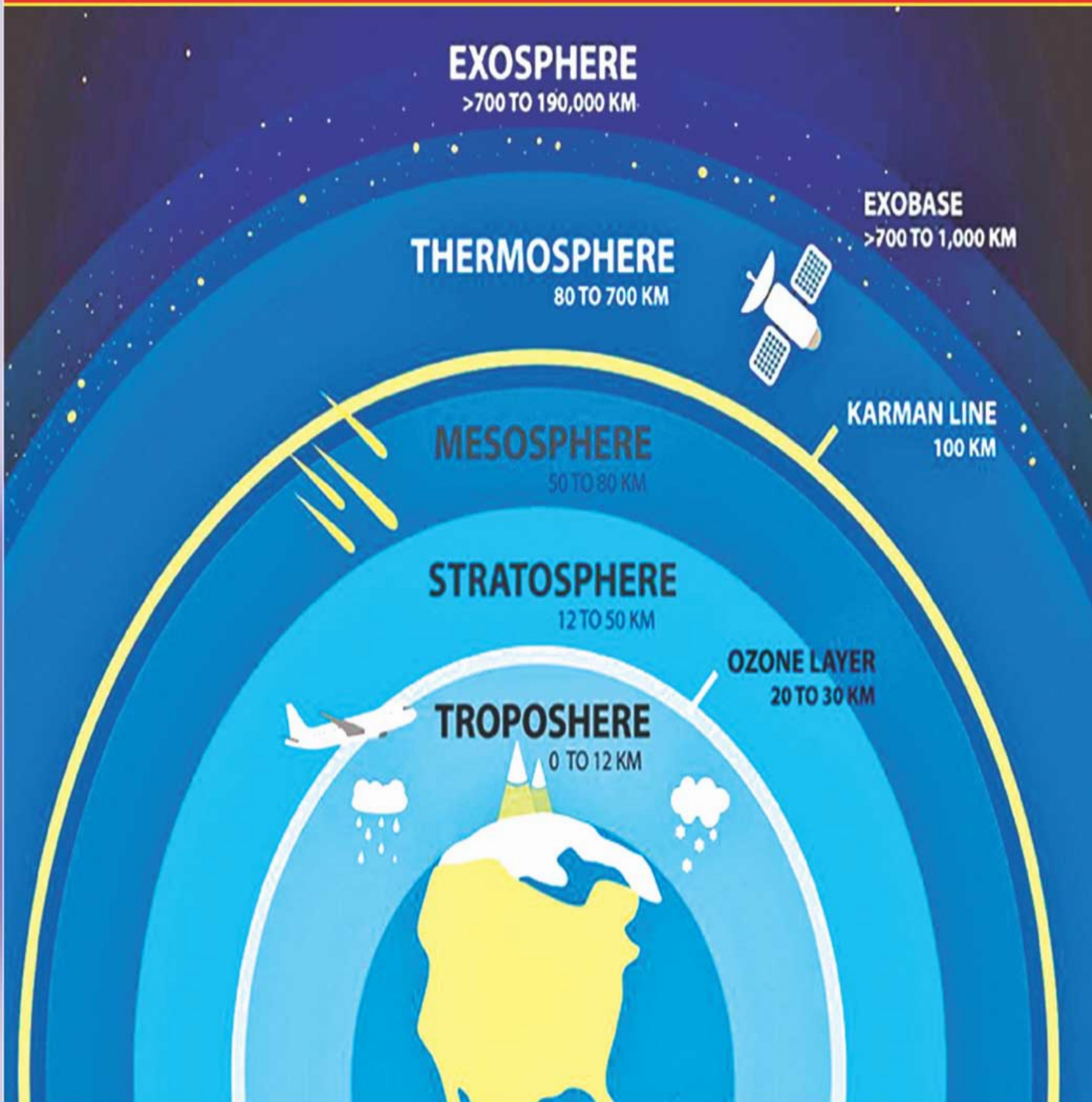

# REQUEST FOR CONTRIBUTING SCIENCE BASED ARTICLES IN ENGLISH

The Secretary, Odisha Bigyan Academy invites articles in English on Basic and Applied Sciences from scientists, technologists and professionals to be published in the English magazine "SCIENCE HORIZON". The articles should be lucid and easily understood by students of Higher Secondary schools, undergraduate students and common readers. They should focus on scientific topics and write articles in a popular style covering information on scientific discoveries/inventions, biography of scientists, eradication of superstitions, development of scientific temper, story, features, snippets etc. The articles should ordinarily be of two to three printed pages in one side of A-4 size paper with attractive headings. The authors whose articles are published in the magazine will be paid a token remuneration for each article. The articles should be sent to the Secretary, Odisha Bigyan Academy at the following address or by e-mail: odishabigyanacademy1@gmail.com.

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# Science Horizon

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*The Cover Page depicts :* **OZONE LAYER** *Cover Design :* ***Kalakar Sahoo***

# EDITORIAL

## OZONE LAYER DEPLETION AND MONTREAL PROTOCOL

In the stratosphere which extends from 10 km to 50 km of the atmosphere, there is a thin layer of ozone called the ozone layer. This layer protects the lives of the earth from the harmful effects of the ultraviolet ray (290 to 320 nanometre wave length) from the sun by absorbing it. Ultraviolet ray damages our DNA and causes skin cancer and cataract. It also damages crops. Ozone is formed by three oxygen atoms and naturally it is formed by the reaction of oxygen with the ultraviolet ray and when ozone absorbs ultraviolet ray it disintegrates. Thus, in nature formation and disintegration of ozone was a continued process and hence, the amount of ozone remains constant in the atmosphere. In 1970s, it was found that the thickness of ozone layer was decreasing. In 1969, Dutch chemist Paul Crutzen published a paper describing effect of nitrogen oxide on ozone. He showed that nitrogen oxide reacts with free oxygen atoms and slows the formation of ozone and this can also decompose ozone into nitrogen dioxide and oxygen. Nobody gave any importance to it. But in 1974, American chemists Mario Molina and F. Sherwood Rowland of the University of California published a research article which showed that human-produced chlorofluorocarbon which contains carbon, fluorine and chlorine was a major source of chlorine in the atmosphere. They also noted that chlorine liberated from CFC by ultraviolet radiation destroyed the ozone. Subsequently, it was confirmed by laboratory measurements and model studies. Crutzen, Molina and Rowland were awarded the Nobel Prize for chemistry in 1995 for this work. It is to be noted that CFC was developed in the USA by General Motors in 1928 for use in place of poisonous gas ammonia and it was called as "wonder material". But after much use, its nature could be known and now its production has been stopped. Scientists found some more ozone depleting substances. These compounds are carbon tetrachloride, methyl chloroform, hydrochlorofluorocarbon, halons, methyl bromide and hydrobromofluorocarbon. These were used in refrigerator, air-conditioner, fire-fighting equipment and some other equipment. Chlorine or bromine, when reacts with ozone, converts it to oxygen. The best known and most abundant of ozone depleting substances is chlorofluorocarbon. A single atom of

chlorine can destroy 100000 or more molecules at ozone. The situation came to such a state that hole appeared in the ozone layer above Antarctica in the winter every year since the early 1980s. Although it is termed as hole, it is not really a hole through the ozone layer but rather a large area of the ozone layer with extreme low amounts of ozone. But that was also alarming and ultraviolet ray could penetrate and reach Earth. The largest decrease in ozone layer take place in high latitudes (towards the poles) and the smallest in the lower latitudes (near the tropics).

When concrete evidence of ozone layer depletion was found out, scientists, statesmen and environmentalists tried for its remedy. In 1985, countries adopted the Vienna Convention for the protection of the ozone layer. Two years later, in a conference held at Montreal in Canada, they adopted the Montreal Protocol on substances that deplete the Ozone Layer, simply known as Montreal Protocol. In this protocol, it was decided to stop the use and production of ozone depleting substances. The ban came into effect in 1989. It has also a financial mechanism, the Mutual Fund, which helps the developing countries comply with the protocol. 197 countries have signed this protocol and acted on it. Montreal protocol is the only universally ratified treaty in United Nation's history and not a single country has opposed it. Due to this, use and production of 97 percent ozone depleting substances have been reduced and the level of these substances in the atmosphere have come down. It is fortunate for human kind that due to this effort, depletion of ozone layer has been stopped, although it will take some more years to gain its former thickness. The ozone layer is expected to reach pre-1980 levels by around 2075.

Montreal protocol has given benefit to another environmental issue which is global warming and climate change. Although carbon dioxide ($CO_2$) is the major gas responsible for the above, the same chemicals that harm the ozone also warm the climate. So Montreal Protocol has benefitted it. It has been estimated that between 1989-2013, the Montreal Protocol prevented the emissions of 5.6 billion tonnes of $CO_2$ equiavalent. Montreal Protocol came into effect in 1989 and hence this year is the 30$^{th}$ year of it. As it was signed on 16 September 1987, the United Nations has declared 16 September as 'World Ozone Day' and it is being observed every year on this day since 1994 to create awareness among people about the importance of ozone layer and its production in our lives.

*Er. Mayadhar Swain*
*Editor*

# MAGNETIC LEVITATION

**Prof. Bipin Bihari Swain**

Aeroplanes fly high in the sky, helicopters move at relatively less height, and drones rove closer to the surface of the earth. But with the technology used in these devices, is it possible to design a hovercraft that floats over your head in the street? Can a train move over the track without touching the rails? Such an antigravity device seems to be impossible today. But magnetically enhanced hover boards and hover cars could become a reality in the future, enabling us to defy gravity and levitate large objects at will. In the future, this objective might become a reality, if room temperature superconductors become a reality.

In factories, heavy loads are shifted by using strong electromagnets. If two bar-magnets are suspended keeping both north/south poles close by, they attarct each other. On the other hand, when similar poles are placed close by, the magnets repel each other.

This principle that two similar magnetic poles repel each other can be used to lift enormous loads off the ground. This is called magnetic levitation. Some countries have adopted this principle on a limited scale though, in magnetic locomotive trains (Maglev trains), that hover just above the railway track without touching it. The train runs with normal engine but the wheels do not touch the track. They have zero-friction and floats over a cushion of air. In principle, such trains can travel at tremendous speed.

In Maglevs, the bottom of the train wraps round the guide way. Maglev uses two sets of magnets - one set to repel and push the train off the track and keep it afloat. Another set of magnets attract and keep the moving train on the track. Levitation magnets on the underside of the guide way are positioned to attract the opposite poles of the magnet on the wrap around section of the maglev.

Maglev trains face the challenge for improving stability, controllability, and cost effectiveness. But scientists are making steady improvement, yet concepts have been implemented only over a limited scale. In 1984, the World's first commercial automated maglev system started operation in U.K. between Birmingham International Airport and nearby Birmingham International Railway station. Next maglev trains were built in Germany followed by Japan and Korea. Because of operational constraints, none of them travelled at very high speed.

The first high speed commercial maglev trains operated between China's Sanghai Pudong Airport and Longayang Roads in 2002 over a stretch of 30.5 km. The top speed of the train was 480 km/h and the train took about 8 minutes for a round trip. The Japanese maglev trains coming next are world's fastest tracks till date, running at a speed of nearly 600 km/h. This speed is obviously faster than usual

wheeled trains, but close to that of bullet trains.

What prohibits the spread of 'Maglev trains'? The high cost involved in its design with available technology, makes its operation uneconomical and as such not affordable. To create strong magnets for use in maglev devices, electric current of large magnitude need be used. Electrical loss due to conductor resistance associated with such a device makes it difficult to maintain and makes the system extremely expensive. One way to avoid electrical loss and increase efficiency would be use of "room temperature super conductors". Scientists have succeeded in fabricating Maglev cars using high temperature superconductivity technology. Theoretically, these trains are capable of running at a speed of 3,500 km/h.

What impedes large scale use of this technology in spreading a Maglev network? A brief introduction of 'superconductivity' and 'superconductors' is called for at this stage.

## Superconductivity

Superconductivity was first observed in 1911 by the Dutch physicist H.K. Onnes while working on the electrical conductivity of metals at low temperatures. He observed that as purified mercury is cooled to extremely low temperature, its resistivity abruptly drops at 4.2 K (Fig.1). Above this temperature, the resistivity is small, but finite, while resistivity below this point is so small that it is essentially zero. The temperature at which this transition takes place is called the Critical temperature ($T_c$). For $T > T_c$, is the normal state and for $T < T_c$, it is the superconducting state of the metals. This is because, at usual temperature, random vibration of the atoms impede the flow of electrons in a metallic wire. By reducing the temperature, these random vibrations are reduced and hence electricity flows with reduced resistance.

The superconducting transition at the critical temperature is reversible. When heated, the superconductor reverts to its normal state above $T_c$. Superconductivity occurs in metallic elements (silver, lead etc.) of the periodic system and also in alloys and semiconductors.

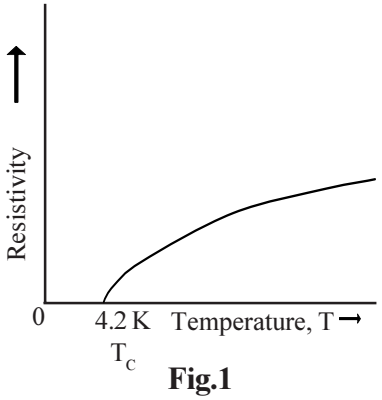


**Fig.1**

The range of critical temperature at present extends from 23.2 K for the alloys of Nb, Ge to 0.01K for some semiconductors. Physicists have found that the upper limit of the resistivity of a superconducting lead may be about $10^{-35}$ ohm. metre which is about 0.00000000000000001 times its value in normal state. So it is appropriate to treat it as zero.

## Persistent Current

If a superconductor has the form of a closed ring in which induced current is generated, the current in it flows continuously without fall in value even after the inducing

source is removed. Such a current is called 'persistent current'. In a typical case, a lead ring in superconducting state, can carry an induced current of several hundred amperes for over one year without break.

Physicists immediately recognised the importance of this result. Power lines lose a significant amount of energy by transmitting electricity along a long distance. But if all resistances could be eliminated as in a superconductor, power could be transmitted almost without loss. In fact, if electricity were made to circulate in a closed circuit made of superconductors, the limited amounts of electricity would circulate for millions of years. As such, electromagnets of incredible strength could be made with little effort and huge loads can be lifted easily.

## Meissner effect

Superconductors also have another property which causes levitation. If you place a magnet above a semiconductor, the magnet will levitate, as if held upwards by some invisible force. This is called 'Meissner effect'. Its reason is that the magnet has the effect of creating a 'mirror image' magnet within the superconductor, so that the original magnets and the mirror image magnet repel each other. Another way to see this is that the magnetic fields cannot penetrate into a superconductor. Instead, magnetic fields are repelled. So if a magnet is held above a superconductor, the lines of force are expelled by the superconductor pushing the magnet upwards and cause levitation.

Using the meissner effect, one can imagine a future in which the highways are made of the special superconductor ceramics. Then a magnet placed in our belt or shoes could enable us to float to our destination without any friction or energy loss.

With such immense possibilities unfolded by use of superconductors, why do we not use them extensively and spread the 'maglev network' on a large scale?

Despite all the miraculous power, the problem with the use of superconductor in Maglev is that it is very expensive as large magnets are to be immersed in vats of super-coded liquid (to come down to the critical temperature) to convert the ordinary conductor into a superconductor at critical temperature (which is close to 0 K). This makes production and maintenance of superconducting magnets prohibitively expensive.

What is the next alternative? In order to make 'Maglev' trains affordable, the solid state physicists should develop the technology to create a 'room temperature superconductor'. It will have no electrical resistance under normal working condition and hence no loss of energy. 'Persistent Current' is an obvious possibility in such situation. The development of room temperature superconductor in the laboratory would spark a second industrial revolution. Powerful 'magnetic fields' capable of lifting cars and trains would become so cheap that hover cars might be a common sight and network of 'Maglev' trains will cover the globe.

In principle, one might be able to wear a belt made of superconducting magnets that

would enable one of effortlessly levitate off the ground. With such a belt, one could fly in the car like 'Hanuman' of Ramayana.

During the last quarter of the 19th Century, search for development of room temperature superconductor became a craze, but without success. It was a tedious hit-or-miss process testing one material after another. But in 1986, a new class of materials were found that became superconductor at about 90 degrees above absolute zero, that is, at- 183°C. The ultimate goal of developing 'room temperature superconductor' seems achievable. Physicists enthusiastically jumped into the race and tried beating one another to break the next world record for a superconductor, that is, inching closer to room temperature. For a brief moment, it seemed as if 'room temperature superconductor' would be a reality and 'levitation' would leap off the pages of science fiction into our living rooms. But after a few years of moving at breakneck speed, research in high-temperature superconductors lost its momentum.

Since about 1993, the high-temperature superconductor has been a ceramic material called mercury barium calcium copper oxide ($H_g Ba_2 Ca_2 Cu_3 O_{8+5}$) with $T_c$=133-138 K. The latest experiment with this material i.e. -135° still awaits experimental confirmation. Room temperature is far, yet, it is still important. Nitrogen liquifies at 77 K and liquid nitrogen costs as much as ordinary milk. Hence it is affordable and could be used to cool down conductors to critical temperature cheaply. Yet the operational constraints of 'Maglev network' remains unsolved. The ultimate solution is development of room-temperature superconductor that would need no additional technology and cost escalation and make levitation possible at affordable cost.

Major limitation in development of high-temperature superconductor is lack of appropriate theoretical basis. The experimental development of a superconductor is based on arranging particular atoms in distinctive layers and study the response in varying configurations. Many physicists theorise that this type of layering of the ceramic material makes it possible for electrons to flow freely within each layer creating a superconductor. But precisely none have the theoretical knowledge and depend on the hit-or-miss procedure for its development.

Recently a team led by Prof. Anshu Pandey and Dev Kumar Thapa of IISc, Bengaluru have claimed to have developed a room-temperature superconductor using silver-gold atoms, both of which are good conductors. It became a superconductor at 13°C, close to room temperature. In this state, its resistivity is 10,000 times lower than that of good conductors like gold, copper and silver. They worked on 128 monostructured samples of silver-gold components. The first report came in July, 2018 and improved version in May, 2019 with a video evidence of magnetic levitation. But many other physicists have challenged their finding and the claim of this group awaits unequivocal acceptance.

If the IISc results stand the scrutiny of the scientific community, may be our search of a room-temperature superconductor has

completed its journey or in case of failure, we may have to wait for the elusive material. How long will we wait? It is a question difficult to answer. But once room-temperature superconductors are a reality, a tidal wave of commercial applications will set off. Magnetic fields that are million times more powerful than the Earth's magnetic field (which is about 5 gauss) can be generated. Maglev trains and Maglev network will cover the entire globe. It may be tomorrow or eternity.

Our discussion on magnetic levitation will remain incomplete unless we discuss more about Meissner effect. The Meissner effect work on magnetic materials, such as iron. But it is also possible to use superconducting magnets to levitate paramagnets and dia-magnets. These substances do not have magnetic properties of their own, but they acquire their magnetic properties only in the presence of an external magnetic field. Paramagnets are attracted by an external magnet, while dia-magnets are repelled by an external magnetic field.

Water, for example, is a dia-magnetic substance. Since all living beings are made of water, they can levitate in the presence of powerful magnetic field. Scientists have levitated small animals such as frogs. But if room-temperature superconductors become a reality, it should be possible to levitate large non-magnetic objects as well via their dia-magnetic property.

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## MAGNETIC RESONANCE IMAGING

**Dr. Prem Chand Mohanty**

In the past days, the modality of treatment was primarily experience based. But in this millennium the physicians emphasise more on evidence. For these they are taking the assistance of modern techniques like ultrasonography, CT Scan, PET scan, MRI etc. But during last 20 years no other modality has so much developed as magnetic resonance imaging (MRI). During it's life span it has covered anatomy to physiology, structural to functional, morphological to tissue diagnosis, and providing biochemical information. As compared to X-rays & CT scan, MRI is the most authentic, reliable and safest tool by which the physicians can well visualise the internal organs to the level of cells & tissues. By this method it is possible to differentiate an affected tissue from a healthy tissue. Also from the images of MRI it is possible to study the consequences of introducing a particular drug to the body of a patient. MRI is less harmful because X-ray and CT scan use ionising radiation whereas the later uses radio frequency signals to acquire images of non-calcified tissues. MRI is far more sophisticated than CT scan as it has a long list of properties that may be used to generate image contrast. By variation of scanning parameters, tissue contrast can be changed and enhanced in a number of ways to detect different features. For purposes of tumour detection &

identification in brain MRI is superior. It is best suited for patients who are to undergo repeated tests in short time interval because unlike CT it doesn't expose the patient to the hazards of ionising radiation. MRI is more efficient than CT scan because the later provides better spatial resolutions but MRI provides comparable resolution with far better contrast one. It is because the MRI scanner includes a library of pulse sequences, each of which can be optimised to provide image contrast based on chemical sensitivity.

## History

For the first time, in the year 1973 this technique came to light with a number of images. In 1974 a complete cross sectional picture of a living mouse was published by using this technique & same technique was extended to the case of human being in 1977, where the activities of some internal organs were depicted through coloured pictures. Due to extensive research work in the field of its primary importance & applicability in the field of diagnosis, Paul Lauterbur of Illinouis University & Sir Peter Mansfield of Nottingham University were awarded jointly with Nobel Prize in the year 2003.

## How MRI works ?

70% of our body weight comprises of water. Each water molecule consists of 2 hydrogen atoms and one oxygen atom. Under normal condition, these protons move randomly but when they come under the influence of an external magnetic field then the magnetic dipole moment of some atoms undergo some changes. For example, some of them align themselves towards the applied field and others are antiparallel to the field. During alignment, not only the spin but also the axis of rotation changes forming a cone. It is called precession. The number of precessions of a proton is called precession frequency which depends upon the applied field strength. At that moment if a radio frequency (RF) pulse is applied then the precessing protons may absorb some energy from it and go to higher energy level and start precessing in antiparallel order. This imbalance results in tilting of the magnetisation in to the transverse plane. For this the precession frequency and radio frequency must be in resonance with each other or else no energy exchange can occur. RF pulse not only causes excitation but also makes them precess in phase. In transverse magnetisation form the frequency possessed by the protons is called Larmor Frequency. This induces a current in the RF coil appearing as MR signal which are transformed into images by computers using Fourier Transformation method. In short, the total process may be ascribed as follows. When a patient coming for MRI is allowed to remain inside the magnetic field then all randomised protons in the body will start to precess along the applied magnetic field. If RF pulse is introduced then the precessing protons after absorbing energy start converting longitudinal to transverse magnetisation. This generates a current which is received by RF coil as MR signal. This signal is ultimately received and converted to images by complex

mathematical process. When RF pulse is switched off longitudinal magnetisation (LM) starts increasing along Z-axis and transverse magnetisation (TM) starts decreasing in the transverse plane. The process of such recovery in the 1st case is called Longitudinal relaxation and the 2nd one is called Transverse relaxation.The time taken by LM to recover to its original value after switching off of RF pulse is called T1, similarly the time taken by TM to reduce to it's original value is called T2. T1 depends upon the composition of tissues, structures & surroundings. For example, water molecules are highly mobile, so protons of water take more time to transfer their energy (longer T1 value) but fatty tissues have short T1 values. T2 depends on inhomogenity of local magnetic fields within the tissues. Due to lack of much inhomogenity water has a long T2 value but for impure liquid or for tissues containing macro molecules have short T2 values. Materials with short T1 value have bright signal but tissues with short T2 will lose their signal earlier. K-space is an imaginary space representing a raw data matrix. It is an intermediate stage between reception of signals and image formation. Here signals are stored as raw data in a definite order which are finally used to reconstruct images by using Fourier transformation. Five tissue variables namely spin density, relaxation times T1 & T2, flow shifts and spectra shifts are used to get contrast images. By changing the parameters it is possible to create images of different types of our body tissues.

## Components Of MRI

Mainly there are 4 components namely 1) A magnet to produce a magnetic field 2) A gradient to localize signal 3) Transmitter and receiver coils for Radio Frequency pulses 4) Computer system.

1) Magnetic Field:- Generally for clinical purposes magnets of strength 0.2 to 3 Tesla are used. But for research work magnets of higher strength (> 3T) are used. In the field of spectroscopy, functional & cardiac MRI magnets of strength 1.5 T is being used .In case of open MRI permanent magnets made of alnico is used . Here field strength ranges from 0.2-0.5 T. To produce field strength of 0.2-0.3 T electromagnets are used which are easy to install and can be tuned easily. But its operational cost is high as it requires continuous power supply & cooling systems. Now-a-days superconducting magnets are being preferred as they don't require continuous power supply. These are made of wires of Nb/Ti alloy being cooled to -269 degree C by surrounding the coils by liquid helium. In all the cases homogeneity of magnetic field must be maintained.

2) Gradients:- These are 3 sets of coils which can vary magnetic field strength in X, Y, & Z directions. Further they can be used for slice selection, phase encoding. frequency encoding and to rephase the protons when they go out of phase.

3) Radio Frequency Coils:- These are loop of wires which are used to transmit RF pulses

into the patient and to receive the signals from the patient. Here energy is transmitted in the form of intense bursts of radio frequency called RF pulse. It helps in causing phase coherence and exciting some protons to move from a lower to higher energy state. Depending upon design RF coils may be volume surface or phase array coils. Volume coil is the main coil located in the magnet bore as the innermost ring which either surrounds the whole body or a specific region. Surface coils may be flexible or rigid & are operated in receive only mode. A phase array coil is made of 2 or more surface coils . Depending upon the number of surface coils PA coils may be 4, 6, 8 or 32 PA coils. With increase in number of elements the rate of dynamic scanning increases.

4) Computer systems:- In present days, computers play an important role in data collection, manipulation, image viewing, storage and documentation .

5) Contrast agents:- Use of contrast agents in MRI improves the quality of detection, delineation and characterisation. They may be of 2 types. 1) Parenteral and 2) Oral. The 1st type are classified on relaxivity and susceptibility. Examples are Gadolinium (Gd) and Iron oxide. Gd is a paramagnetic agent which reduces T1 & T2 of the tissues where it accumulates. It increases signal of T1w & reduces that of T2w images. In the form of chelates Gd is available as gadobenate and gadxetate which have more stability. So they can stay for a longer time and are excreted in part by our hepatobilliary system. In order to get clear pictures of blood vessels, tumours or sites of inflammation contrast agents are injected intravenously to the patient's body. But in making arthrograms the contrast agents can be directly injected into the affected sites. This technique can image every part of the body but is of immense help for those tissues having a vast number of H nuclei like brain, muscle tumors and connective tissues. In a given MRI examination, 5-20 sequences are taken out of which each one is chosen for a particular information about the affected tissues.

## Applications of MRI

Out of so many applications let's discuss some.

1) Magnetic resonance Angiography:- This method is used for vascular assessment. It is of 2 types. a) Non contrast & b) Contrast enhanced MRA. For evaluation of circle of Willis arteries and for nephrogenic systemic fibrosis non-contrast MRI is preferred. In contrast enhanced MRA a dose of 0.2 mmol/kg of Gd is injected to make T1 of blood shorter than that of fat and muscle so that it will appear brighter than fat. Keyhole imaging is applied to CEMRA for improving the temporal resolution.

2) Magnetic Resonance Diffusion:- The protons of water molecules often diffuse to dissipate their thermal energy. The difference in mobility of these molecules in tissues gives the contrast in diffusion weighted imaging

(DWI) and it helps to characterise normal and pathological tissues. The recent development of diffusion Tensor Imaging (DTI) enables diffusion to be measured in multiple directions and hence makes it easier to make brain maps, to examine the connectivity of different regions of brain and to examine areas of neural degeneration & demyelination in multiple sclerosis. It is also helpful in detecting ischemic stroke, cytotoxic edema and cerebral perfusion.

MRI Scan

3) Magnetisation Transfer MRI:- In protein molecules water may be present in free or bound state. In free state protons exhibit translational & rotational motions thereby disturbing the surrounding magnetic field. This is called motional averaging but protons bound to proteins tend to have a fixed orientation. So the average magnetic field doesn't average to zero. This provides an indirect method to measure the macromolecular content in tissues.

4) Fluid attenuated inversion recovery ( FLAIR ):- It is a pulse sequence used to null signal from fluids. So it can be used in brain imaging to suppress cerebrospinal fluids so as to bring out periventricular hyperintense lesions such as multiple sclerosis plaques.

5) Magnetic resonance spectroscopy:-This technique is used to measure the levels of different metabolites in body tissues. The MR signal produces a spectrum that correspond to different molecular arrangements of the isotopes being excited. This signature is used to diagnose metabolic disorders especially affecting the brain and to provide information on tumour metabolism. Now a days it is used to differentiate radiation necrosis and gliosis, neonatal hypoxia, stroke, epilepsy, alzheimer's dementia, hepatic encephalopathy, abscess, HIV and AIDS.

6) Cardiac magnetic resonance imaging:- It provides anatomic and functional informations in acquired and congenital heart diseases such as differentiation of constrictive pericarditis from restrictive cardiomyopathy and aortic dissection. Also helps in assessment of myocardial viability and perfusion ,ventricular function, cardiac and pericardial masses etc.

7) Magnetic resonance cholangiopan-creatography:- This technique is used in diagnosing cystic diseases of bile duct, congenital anomalies, choledocholithiasis, post surgical complications, chronic pancreatitis and neo plastic lesions.

8) Functional MRI:- It measures signal changes in the brain that are due to changing neural activity. Here the brain is scanned at

low resolution but at a rapid rate. Increased neural activity causes an increased demand for oxygen and the vascular system actually overcompensates for this, increasing the amount of oxygenated haemoglobin relative to de-oxygenated haemoglobin. This technique is used in understanding brain functional areas and psychiatric diseases, estimation of risk of postoperative deficit and in determination of hemispheric dominance for languages.

Besides these important uses MRI provides a greater possibilities to be applied in other areas such as enterography, urography, iron overload imaging, arthrography and elastography and many others . This lengthy discussion on MRI proves that we have not yet been able to reach up to a part of this modern technique. It requires an extensive research in this field to reveal it's hidden treasure. Ultimately a day will come when we will be using this technique just like we use X- rays in these days. Let's hope for the best.

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# CAN ARTIFICIAL INTELLIGENCE IMPROVE LEARNING

**Soumya Ranjan Das**

Professor and cognitive researchers frequently depend on test scores to determine how well students comprehend lessons. However, this practice ignores many critical aspects of learning, such as the engaging effect of classroom discussion or interests and motivations of classroom learners.

By convention, a neutral observer would be required to recognize these unquantifiable moments of a great teaching experience but human observations are time-consuming and expensive. One can video tape classrooms, but that would be just as cumbersome and costly, requiring an expert to interpret and analyze that recordings afterwards.

Because of advances in artificial intelligence, education researchers and computer scientists have come up with ways to create smart systems that can observe and listen in on classrooms, and instantaneously analyze the quality of a teacher's classroom delivery. This technology has gone through several enhancements as a result of improvements in natural language processing and automatic speech recognition with current technology. However, it takes a huge amount

of work simply to teach these robots, how to observe one micro aspect of a classroom at a time.

## Can algorithms replace expert observers?

Observing human behaviour is different from measuring variables in a Physics Experiment. Rational assumptions made on the basis of observations of large groups would break down at the level of the individual. Further, due to our limited understanding of all the facets of great pedagogy, we might miss out on an aspect that is crucial to motivating a particular type of learner.

This is because questions as complicated as morality and religious belief are not universally agreed upon. Humans respond to each other. A smile or an act of kindness at the appropriate moment cannot be enacted by a machine. Quite often small gestures make a world of difference to the choices an impressionable mind will make.

## AI does enhance the learning experience

Hard data can indeed help indentify learning challenges for individual students. Virtual reality can enliven a science lesson visually, and for engineering students, in particular, simulate and break down connections between moving parts in ways that even the most imaginative teacher cannot put together in a lecture. Engineering education in India is being criticized for churning out unemployable graduates in large numbers.

Most of them seem to lack communication skills and find themselves at a loss when asked to solve practical challenges in the work place. Technologies such as Artificial Intelligence and virtual reality can help monitor and identify personal preference and aptitudes and they can do this much faster than any human, providing the opportunity for much needed intervention at exactly the stage at which it is required. That is the crux of providing students with a complete vocational experience and making their education relevant to what is required by industry.

## Inherent Bias of Algorithm Designer

One of the advantage of letting machines decide the capacity of learners is that they can process large amounts of data with precision. However, the parameters on which that measurement is made have still been created by a human. That means that a social researcher has made a choice about which attributes are important and which are not. One cannot penalize teachers with low-performance ratings based on a subjective scale if their students have gained great learning experiences. What artificial intelligence can do in this scenario, however, is that it can provide insights into good teaching practices.

## Learners perspective

From the perspective of the student, not gifted in language, visual imagery can enhance grasping powers using spatial relationships between objects and their relative sizes. Artificial intelligence monitoring intelligence can enable the student to know where she/he stands in respect of defined learning outcomes.

Lesson can be paced, repeated and modified to match a learners's rate of comprehension in this age of short attention spans and social distractions, making learning relevant to real life situations encountered by a particular age group which can mitigate some of the dreariness of a technical module.

## Industry Perspective

From the point of view of the industry, artificial intelligence finds applications in screening resumes and rank candidates by proficiency. It can also be used to predict which candidate would be successful in an assigned role. AI programs are being used to tag, organize and visually search content by labelling features of an image or video for market researchers.

A report published in the Economist estimates that advances in robotics, AI and automation could potentially cost 800 million jobs worldwide within a few decades. However, in the best case scenario, engineers or technical workmen in a small number of at-risk occupations would find themselves jobless.

It is the ability to introspect and innovate outside the box that gives humans the edge over automations. While artificial intelligence may be able to enhance productivity and improve upon mechanical tasks, it can not learn independent of experience.

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# ENERGY OF THE FUTURE

**Dr. Sadasiva Biswal**

## Prelude

In the early days, the discovery of fossil fuels like coal, petroleum and natural gas paved the way for large scale consumption of energy for electricity, transport, agriculture, industries, space research and so on. But there was one side effect, i.e. environmental pollution.

The fossil fuels, when burnt released carbon dioxide, a greenhouse gas (GHG) responsible for increasing global temperature. Industrialisation has led to atmospheric concentrations of $CO_2$, methane and nitrous oxide that are unprecedented in at least the last 800,000 years. And with rising global temperature came erratic weather events, rapid melting of snow and the increasing sea level. In order to free from such environmental hazards, people thought of alternative energy sources which will be environment friendly.

Scientists have already taken up this challenge of finding an alternative energy source that can power our appliances and gadgets without releasing $CO_2$. And in 1839, French physicist Alexandre-Edmond Becquerel found one such source and this is the solar energy. Here after, the story of renewable energy began.

## Solar Energy

The sun is the source of all energy. It is the storehouse of unlimited energy. We have

been trying hard since long to trap the solar energy for our use. Well, we are still in the nascent stage but we have travelled a long distance in a very short time. In the past, harnessing solar energy was at best a science fiction plot a few decades ago, but today it is as common as the newspaper! From trains to cars to street lights and toys, everything runs on solar energy. The most important aspect of solar power is that it does not emit $CO_2$. It is absolutely pollution-free.

## Solar Revolution: The India Story

All our appliances in our house need electricity to work. Therefore, electricity is considered one of the most valuable commodities in the world.

With rapid economic growth and urbanisation, there has been an increase in energy demand and consumption. India and China, two of the fastest growing economies in the Asian subcontinent, are no different in this respect. In 2018, India, China and the US accounted for nearly 70 percent of the rise in global energy demand, said a recent report released by the International Energy Agency (IEA).

As of August 2019, the install capacity of power station in India is 360788 MW. Of this, more than half is from coal. Developing countries like India and China, also two of the world's most populated countries, have the daunting task of finding sustainable and affordable electricity solutions for billions. Therefore, much like the rest of the world, coal-based thermal plants are still the leading source of electricity in both the Asian countries, whereas oil is the second major source.

However, energy from renewable resources like the sun, wind, water and nuclear reactors are slowly showing us the road to a cleaner future.

To lower the dependence on coal, India has set a target of 175 GW of installed capacity from renewable energy by 2022. Of this, 100 GW would be solar energy.

There will come a day when renewable energy would be used to power not only our homes and industries but even our cars, trains and some day, may be even our aeroplanes. And for India in particular, that day may not be very far. According to a 2018 study published by University of Technology (LUT) in Finland, India has the capacity to operate entirely on renewable by 2050.

## Solar Power in India

The world's first fully solar powered airport has been established in Kerala and the largest solar rooftop has been installed on a cricket stadium in Mumbai. This shows that India has made giant leaps in the field of solar energy. Thanks to the falling prices of solar installations in India, sourcing energy from the sun to meet our energy needs is no longer a luxurious enterprise. Take the Bhadla Solar Park in Rajasthan for example. Hundreds of solar panels are seen glistening in this over 45 square kilometre stretch of the Thar desert.

The journey of solar power in India has undoubtedly been remarkable but there are emerging challenges that call our attention.

According to "The State of Renewable Energy in India" report released by the Centre for Science and Environment (CSE), the country's focus has mostly been on large scale solar installations and household supply constitutes only a small pie (roughly 15%) of the total installed capacity of 3399 megawatts (MW) until September, 2018.

Reservations regarding cost and energy efficiency have been major factors for this. Despite the fall of prices and government subsidies, individual consumers are reluctant to invest in a technology that they know little about. Added costs such as money spent on the inverter and battery (prices of which are high) also deter individuals from investing in solar rooftops.

## Epilogue

Over 30 lakh homes are now in dark in India as per government data while solar energy has been able to power our railway platforms, government offices, street lights and other public spaces. It has not been able to act as a revolutionary force for those who need it the most. And it is here that solar rooftops can play a key role. They can help provide clean energy to the poorest of poor in our country who are forced to live in the dark even today.

Not only this, surplus energy generated from rooftop solar plants can be connected to the main grid, thereby improving the supply network.

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# ENVIRONMENTAL PROTECTION IN HIGHWAYS & BUILDING CONSTRUCTION

**Er B.C. Padhi**

The construction activities in the country are set to take a faster pace in the coming days with the present Government drawing its road map of long -term infrastructure development. We have developed road infrastructure a great deal, however a lot is yet to be done. Although road infrastructure has come of age, we are still far behind to discharge our duty towards society to save environment.

Towards achieving this responsibility we may take up a number of initiatives. Recently Hon'ble Prime Minister during his speech on Independence Day has categorically advised to ban single use plastic. In the first instance, we may take it as a campaign to act towards achieving this goal. What is more important is that we can contribute a great deal towards use of waste plastic in road construction. As an initiative, certain locations on Highways may be identified near urban area for collection of waste plastic and create facility for its segregation and shredding for use in the construction of bituminous pavement layers. At present the contractors find it difficult to get the requisite quantity of plastic waste in segregated manner for such use.

Our concerted efforts towards making its assured availability can very well find its greater use in the bituminous pavement and serve the nation towards getting rid of waste plastic which is otherwise endangering the environment.

It is common site of felling of age old trees for construction or widening of roads in urban and rural areas. Though there are provisions in road estimates for compensatory plantation hardly these are visible on the ground. From good old days of Kings ruling the country, road side tree plantation , creating water bodies embankment protections was considered a must for social and environmental protection. The King who looked after such infrastructural improvement was considered as a good ruler. Road side trees were not only playing a major role in the climatic balance , enriching the environment and housing for different birds and creatures but also used to provide fodder, flowers, fruits, dry leaves for fire and its whole body for different medicinal uses. Humans used it for disposal of the body after death.

The pedestrians who were numerous then for pilgrimage and travel, as such benefited the most by its shade. During Moghuls and British regimes too it used to be considered as a beneficial activity for planting and protecting trees. As a Hindu ritual after taking a bath it was customary to pour water at the roots of a tree with prayers to Mother Nature. After industrialization everywhere the first bell of death rang on forest and plantations. Modern transportation considered a tree as a hindrance to sight of vision and a cause of accident. On increase of motorized traffic and their speed, more lanes were needed and this called for widening of the pavements. To keep the road alignments which were then a perfect straight line as such, but for widening the road way, it became expedient to fell the road side trees, some more than hundred years old from both sides.

The so called improvement of living standard needed more buildings and urbanization .Use of strong and beautiful wooden door choukat, doorframes, furniture, eroded reserved forest by clandestine fellers in collusion with corrupt officials or with threat to life by mafia groups. This rampage left first the road barren and depletion of forest cover countering reforestation drive of Government, with a serious effect on environment.

On realizing the effects of felling of road side trees, compensatory plantation were included in highway contracts for planting multiple numbers to the trees actually cut. Even this went neglected with sparse attention by all. Subsequently the provision of plantation cost in the estimate were decided to be deposited with local forest authorities. It was left to them to decide the type of trees, at what intervals to be planted and at what time of the year and they took charge of nursing them till the saplings are able to survive on their own. Of course the line of plantation away from road centerline and its slopes and drains were designed by Engineer in charge.

With stringent forest rules and restriction on felling trees for firewood, control over entry to reserve forest, the easy target were the road side trees which became most vulnerable. It became a common scene of every village to leave home with an axe hanging on the shoulder and attack a good old tree from its branches first. Then the attack was on its trunk daily taking out layer by layer around it. This continued till it became so narrow that it cannot any more bear its body weight and falls. Then gradually the tree will vanish leaving the land barren.

During the service career, this writer as PWD SDO, the above described eyesore was at Kalahandi from 1966 to 1968. The matter was duly reported to police for suitable action. However, the response from the authorities was lukewarm to say the least. Forest authorities said they were busy in the reserved forest areas and had no manpower to attend. The Engineer without any powers to implement prohibitive actions supported by an act of State like all other departments had no other option but to watch silently their death. In hardly a year's time, the road leading to Kesinga Railway head, gate way to Kalahandi from Bhawanipatna was devoid of trees. We did some plantation getting seedlings from forest people and maintained them through our road gangs. Again during 1984 to 1985 at Boudh using the support staff many people were caught while felling road side trees and were taken to office with their axes and reported to police for action. People used to runaway leaving their axes. PWD store had a bunch of axes at the end. Compared to this the law abiding citizens of Ganjam, Koraput, Raygada, Nabarangpur, Gajapati deserve special mention where many old trees are still standing where widening has not begun. The locals took great care for the plant's survival and growth.

During 1990 to 1994 I was project manager of IDCO at the Ordnance Factory at Badmal in the District of Bolangir. The site was in deep forest with hills, nullah and undulating ground harboring varied species of animals, birds and insects. It became necessary to cut more than thousand trees big and small including uprooting their stumps. This was for the construction of factory for Filling station of Bofors Gun Shells. Removal of the stumps which were deep rooted was a Herculean task, unless done would have created a lasting nuisance in maintaining, the newly constructed buildings and thirty kilometers of boundary wall and its inner perimeter road and township. It was in forest area with wild animals. Plantation continued of course by the side of township roads and vacant areas. The security perimeter wall needed support of a number of grating arrangements at stream crossings. These had to allow the flood water to pass through along with floating debris but not allow a person to get in for security reasons. This was for all nullah and streams across a number of culverts and five number of bridges were planned, designed and executed in record time under trying conditions of extreme climates with frequent malaria attack to laborers'.

In building construction, use of flyash bricks, aluminum and glass in window frames, concrete or hollow steel sections for choukat, resorting to plastic tables and chairs and bath room doors and choukat, switching over to polymer impregnated waste products for doors and furniture and interior uses, replacing wooden floorings with ceramic tiles, have scaled down pressure on timber. All these have better effect on environment.

In Highway sector, initiative to popularize use of re-cycled material in road construction will go a long way in reducing pressure on minor minerals. While studying the level of pollution in urban areas it is seen that apart from carbon dioxide emissions of vehicular traffic, the highest form of pollution comes from wastes from construction activities. Hence awareness and inputs of knowledge and technology is necessary in keeping pollution under control. There is a greater need to

popularize use of locally available materials for construction of roads, use of soil stabilization, geo-textiles, geo-polymer, turfing through local grass on embankment slopes etc.

Another area which also needs equal attention is the depleting ground water level for which policies and the process of water harvesting on highway has to be ensured and taken up as a campaign. While constructing culverts across streams, cutoff walls be provided along with floor protection works and the upstream cut off wall be raised a meter above the apron level. This will create water bodies and accumulate water up to a good length of distance on the upstream side to provide drinking water to domestic animals and recharge the ground water level of nearby wells of the locality. This is not going to cost additional money. Moreover, thickening of the floor apron will lead to absorb the energy of the fall during high floods.

The efforts of all stake holders, road and building engineers towards achieving these long cherished aim would be greatly appreciated by the society at large.

Use of non conventional energy sources, less exploitation of earth and forests, less pollution of atmosphere and water, increasing green cover will go a long way to sustain the population growth of the world. Research and Development on all environmental issues need to be pursued diligently so as to create a better tomorrow for the future generation.

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# KIDNEY: THE CLEANING CREW-3
## (PERITONEAL DIALYSIS)

Prof. Prafulla Kumar Mohanty

## Survival: a desire

All animals including human beings want to survive well and continuance of the species through reproduction. When they suffer from diseases or illness, they become unhappy and think of treatment in best possible ways. Sometimes, the pain and problems occur in such a chronic or acute manner, patients desire to have an immediate death. Even now-a-days, some people opt for euthanasia to overcome physical, mental and psychological torture.

However, kidney disorder or renal failure is one of the serious problems which needs to be addressed in appropriate time. The hazard is when the patient is advised for transplantation (to graft or to remove and establish elsewhere or to implant upon another animal or another part of the same), it is indeed difficult to get a donors' kidney. In previous topic already a particular technique named haemodialysis is explained in detail which is one of the effective means to restore the patient's health. The second option to resolve the issue is "peritoneal dialysis" which is elaborated hereafter.

## Peritoneal dialysis

Peritoneum is a membrane that lines the abdominal cavity of the animals including

human beings (Gr. Peritonaion to stretch all round). This peritoneum (lining of the abdomen) acts as a natural filter. This is used in peritoneal dialysis. In this technique, the abdominal cavity (belly) is to be filled up with the dialysis fluid (dialysate) through a soft plastic tube called catheter. The peritoneal membrane that lines the abdominal cavity has many small blood vessels. It serves as a semi-permeable membrane between the blood of the patient and dialysate. The dialysate stays in the abdomen and absorbs wastes and excess fluid from the blood for several hours. This may be drained out and replaced with fresh dialysate (Fig.1)

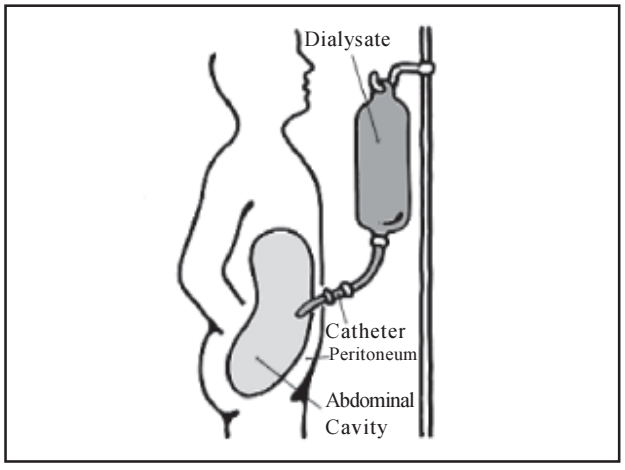


**Fig.1:** Process of Peritoneal dialysis

Peritoneal dialysis (PD) can be performed manually by carrying out four to five fill-and-drain exchanges per day. This is known as "Continuous Ambulatory Peritoneal Dialysis (CAPD)". To reduce the number of day time exchanges, some people can use a machine called a cycler to undertake exchanges, usually during sleeping at night. This is known as "Automated Peritoneal Dialysis (APD)".

Before first treatment, the doctor places a small, soft tube called a catheter into the patient's abdomen. This catheter remains there permanently. One end of the catheter rests in the peritoneal cavity, while the other extends out from the body. Catheter helps to transport the dialysis solution to and from the patient's abdomen or belly.

Peritoneal dialysis fluid is a sugar solution containing other salts. Bags come in a strengths like 1.36%, 2.27%, and 3.86% or light, medium, and heavy, respectively. The heavier the bag (3.86%), more water will be removed from the body. If lot of fluid is there in the body, heavy bags may be used to remove the fluid. If the patient is dehydrated, some light bags may be used, so that the dialysis does not remove fluid.

The catheter is the permanent access for the peritoneal dialysis and may not be removed between the treatments. If it is cared systematically, the catheter can last for many years.

## Precautionary measures

Following precautions must be taken during the process of peritoneal dialysis.

(1) Hands must be washed properly.

(2) Work surfaces must be very neat and clean.

(3) Touching the connector where bags are attached to the tubing must be avoided.

(4) Breathing germs on the connection must be avoided by using a mask.

(5) Exit site should be very clean.

## Possible problems

The following problems may occur during treatment.

(1) Fluid leakage may be there in the groin or around the catheter.

(2) Fluid overload may be noticed.

(3) Mainly 2 types of infection, i.e. exit site infections and peritonitis (infection in peritoneum) may be noticed.

## What does dialysis do?

Like healthy kidneys, dialysis keeps the patient's body in balance. Exactly, it performs the following;

(1) It removes wastes, salts and extra water to prevent them from building up in the body.

(2) It keeps a safe level of certain chemicals in the blood, such as potassium, sodium and bicarbonate.

(3) It helps to control blood pressure.

## Conclusion

Kidney failure is not always permanent. Some kinds of acute kidney failure get better after treatment. In some cases of acute kidney failure, dialysis may only be needed for a short time until the kidneys get better. In chronic or end state of kidney failure, kidneys do not get better and dialysis for the rest of the life is a must. The time required for dialysis depends on following factors.

i. How well do the kidneys work?

ii. How much fluid weight does patient gain between treatments?

iii. How much waste the patient has in his body?

iv. How big is the patient?

v. The type of artificial kidney used.

In fact, dialysis does some of the work of healthy kidneys, but it does not cure the kidney diseases. The patient needs to have dialysis for the whole life unless the patient is able to get a kidney transplant.

Therefore, there is a saying –

"Control life or else life will control you."

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## World Heart Day

World Heart Day is observed on 29th September every year for raising awareness about cardiovascular disease, including heart disease and stroke. Cardiovascular disease is the world's number one killer today. Cardiovascular diseases (CVDs) take the lives of 17.9 million people every year, 31% of all global deaths.

According to the World Heart Federation, at least 80% of the premature deaths (because of cardiovascular diseases) can be protected by controlling four main risk factors such as unhealthy diet, tobacco use, lack of physical activity and use of alcohol.

# CARE AND NUTRITION FOR "FIRST 1000 DAYS OF LIFE"

**Dr. Diptimayee Jena**

The first 1000 days of human life cycle starting from the period of conception to second year of child's age is a unique period for growth and development.Optimum growth and development occur during this period. The first 1000 days of life is divided into three important phases, 270 days of pregnancy, 180 days of infancy (0-6 months) and another 550 days of the period of toddler (7-24 months). During this period optimum care and nutrition are required just to inculcate "**catch them young**" to become a good human resource for the nation. Therefore, balanced diet is required to get balanced nutrition for growth and cognitive development during these 1000 days. The nutritional status of first 270 days in pregnancy and 180 days of infancy along with 550 days of lactation and childhood is directly connected to the birth weight and subsequent growth of infant. The period of pregnancy is a demanding physiological state which is extremely important for growth and development of foetus into a full term baby. The right nutrition for the mother and for the child during this period can have a profound impact on the child's growth and development and reduce the risk of diseases as well as protect the mother's health. Breastfeeding in the first two years of life are extremely crucial to a child's long term health. Mother's milk provides all nutrients that a baby needs for proper development. Colostrum provides antibodies to fight common illnesses and has been found to help with reduced susceptibility to allergies. It is recommended to breastfeed exclusively for the child's first 6 months of life and then slowly introduces food, while continuing to breastfeed up to the child's second birthday. Feeding with appropriate, adequate, and safe supplementary foods from six months onward contributes to better health and growth outcomes, although breast milk remains an important source of nutrients until children reach the age of two years.

The pregnant and lactating mothers are to eat foods of all food groups for their own nutritional needs as well as those of their growing foetus. However, recommended combinations of cereals, pulses, nuts and oilseeds, milk, fresh fruits and vegetables particularly green leafy vegetables and non-vegetarian items also provide adequate nutrients to meet their demand. Bioavailability of iron can be improved by using fermented and sprouted grains and foods rich in vitamin C such as citrus fruits, amla, guave etc.. Milk is the best source of biologically available calcium. Though it is possible to meet the requirements for most of the nutrients through a balanced diet, pregnant/lactating women are advised to take daily supplements of iron, folic acid, vitamin B and calcium.

## 1000 days status in Odisha

Maternal and child undernutrition remain public health concern in Odisha. It has got the largest number of undernourished children and mothers between the age group of 15 -45years. Micronutrient deficiencies i.e. "Hidden Hunger" are one of the major factors that contribute towards malnutrition poor health particularly within 1000 days of life. Low income households fail to purchase nutritious foods due to rise of food prices. Despite implementation of various nutrition intervention schemes and programmes, the nutritional status of children in Odisha remains far from the target according to National Family Health Survey Report (2015-16). The rate of stunting and wasting among children has shown only a marginal decline over the last 10 years. The achievement of taking colostrum within one hour just after birth was observed 68.6% and exclusively breast fed up to 6 months of age was 65.6%. About half (51%) of women in Odisha are suffering from anaemia including 41 per cent mild, 10 per cent moderate and 1 per cent severe. In contrast, 36.5 per cent pregnant mothers of Odisha consumed iron and folic acid tablets (NFHS-4). It is more rampant among tribal community specially forest dwellers. Anaemia can also be caused by malaria, hookworms and helminths, other nutritional deficiencies, chronic infection and genetic conditions. Diarrhea is a major concern in developing countries, as it is the cause of 1.3 million deaths of children each year. Most of these deaths occur within the first 6 months and 2 years of age. Diarrhea causes vital nutrients to be lost from the body which can lead to malnutrition, which in turn, decreases the body's ability to fight infection, making diarrhea episodes more frequent.

Under-nutrition during pregnancy affecting foetal growth, is a major determinant of stunting and can lead to consequences such as obesity and nutrition-related infectious diseases in adulthood. Particularly in tribal areas there is much food restrictions during pregnancy and lactation due to social taboos and superstitions which can lead to low secretion of mother's milk to feed exclusively breast fed infants. As a result children do not gain proper weight upto two years of age. Food beliefs and taboos during pregnancy and lactation are of much concern for under-nutrition. Under-nutrition during pregnancy affects foetal growth and results low birth weight (LBW), a major causative factor of stunting, wasting and can lead to obesity and nutrition related non-communicable diseases in adulthood. Permanent damage due to micronutrient deficiencies can be done during these 1000 days of life. For example, a pregnant woman with insufficient folate could give birth to a child with defects such as neural tube abnormalities. Micronutrient deficiency is responsible for childhood morbidity and mortality. When a mother is poorly nourished, she cannot pass along enough vitamins, minerals, and other aspects of nutrition to her baby to have a successful pregnancy. This can result in having an underweight child, and an increased risk of infections.The most common nutritional disorder found in tribal community

is iron deficiency which can lead to maternal mortality, premature birth, low birth weight, and anaemia. Iron deficiency anaemia leads to a lowered resistance to disease and a weakened ability to learn and grow. Excess intake of beverages containing caffeine like coffee and tea adversely affects foetal growth during pregnancy and inadequate milk secretion during lactation.

## Issues during "first 1000 days of life"

Nutrition-specific and nutrition-sensitive issues in undernutrition dense areas, particularly tribal pockets to be identified and strategic interventions are to be taken on priority basis. The followings major issues in tribal areas need to be addressed through various interventions during 1000 days of life.

## Nutrition–Specific Issues

***First 270 days***

**Pregnant mother**

- Poor nutritional status of mother results in Low Birth Weight (LBW) baby.
- Food restrictions during pregnancy due to social taboos and superstitions causes under-nutrition
- Drudgery prone activities in household and farm sectors by the women during pregnancy.

**Foetus**

- Under developed foetus with low birth weight
- Micro nutrient deficiencies resulting deformation of foetus

***Next 180 days (0-6 months)***

**For lactating mother**

- Food restrictions during pregnancy due to social taboos and superstitions
- Under-nourishment results low milk secretion
- Lack of taking food based galactogauges for enhancing milk production

**For infant**

- Poor growth due to insufficient mother's milk during lactation
- Low Birth Weight baby (LBW) fails to gain weight in subsequent years due to morbidity
- Lack of care by the tribal mother, responsibility shifted to younger children or very old grandmother who are not able to take care of the child

***Next 550 days ( 7-24 months)***

**For lactating mother**

- Under nutrition and lack of nutritious foods during lactation
- No attention towards lactating mother by other family members

**Toddler**

Growth faltering may happen at the time of introduction of supplementary feeding either excess food given to child or unhygienic handling of infant food

- Late or early introduction of supplementary feeding
- Frequent attack of diseases due to poor sanitation
- Negligence of care by mothers

- Stunting / wasting occurs due to persistent nutritional deprivation

## Nutrition –sensitive issues

- Low production from own farm (crops as well as livestock) due to traditional practices particularly among tribal farmers.
- Poor maintenance of backyard kitchen garden resulting low vegetable production for own consumption
- Crop loss due to climatic fluctuation in rain-fed farming
- Consumption of protein rich foods, milk and milk products were found to be very less
- Male migration over-burdens women to run family neglecting her health as well as children
- Poor communication of forest dwellers restrict their access to health care services and nutritious foods
- Tribal women are forced to neglect their children for their day-to-day livelihoods since they are the active earning member in their households

## Strategic measures

Care and nutrition during first 1000 days of life lay the foundation stone for child's future wellbeing and all round development. To achieve these, various nutrition-specific and nutrition-sensitive policies and programmes have been implemented nationally as well as state wise to address under-nutrition and other dimensions of health, food and nutrition security.

- Scaling up close monitoring on implementation of various programmes implemented by Government as well as Non-Government Organizations ( NGOs) need to be addressed extending support to the beneficiaries.
- Nutrition-specific interventions like prompt action against infectious diseases, promotion of antenatal and post-natal care, decrease open defecation, safe water and sanitation, are to be intensified on priority basis.
- In addition, dietary diversification and increased intake of balanced foods for women, improved supplementary feeding practices for infants and toddlers, micronutrient fortified foods for all target groups under 1000 days are the major strategies to reduce stunting, wasting and undernutrition from target population.
- Implementation of Integrated Farming System Approach, development of nutritional garden year round, promotion of off-farm activities and agro-entrepreneurship, women empowerment through SHGs.
- A pregnant woman should undergo periodic health check-up for weight gain, blood pressure, tetanus toxoid immunization, folic acid and iron supplementation regularly.

- Tea, coffee, smoking, tobacco chewing and consumption of alcohol should be avoided.
- The most important food safety problem is microbial food borne illness and its prevention during pregnancy is one of the important public health measure. Avoiding contaminated foods is important protective measure against food borne illness.

## Conclusion

Now the slogan is "**Ending Poverty and Hunger by 2030: An agenda for global food System**". The world food programme prioritizes to end hunger, achieve food security, improve nutrition and promote sustainable climate smart agriculture because eradicating hunger and malnutrition is one of the great challenges among all developing countries particularly South Asian countries. To address this challenge, nutrition-specific and nutrition-sensitive interventions are the key issues which need to be included in various programmes in a convergence mode. The combination of good health and reduced disease risk for both mothers and their children can also have a powerful, lasting effect on a country's prosperity.

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# FREE RADICALS, ANTIOXIDANTS AND PLANTS

**Taranisen Panda[1]**
**R B Mohanty[2]**

Free radicals are highly reactive molecules or chemical species capable of independent existence. They are the molecules with unpaired electrons. Free radicals are present everywhere, i.e. in air, in our bodies and in materials around us.

## How Free Radicals are Formed

Normally chemical bonds don't split in a way that can leave a molecule with an odd, unpaired electron. But when weak bonds split, free radicals are formed. They are very unstable and hence react quickly with other compounds, trying to capture the needed electron to gain stability. Generally, free radicals attack the nearest stable molecule, stealing its electron. When the attacked molecule loses its electron, it becomes a free radical itself, there by initiating a chain reaction. Once the process is started, it can cascade. It is estimated that, the chain reaction can trigger $6.023 \times 10^{21}$ billion molecules to react per second.

## Production of Free Radicals in Human Body

Free radicals, particularly reactive oxygen species (ROS) and reactive nitrogen species are generated in human body by various endogenous systems and activities in mitochondria, peroxisomes, inflammation, phagocytosis, archidonate pathway, exercise, ovulation and fertilization. Some times body's

immune system purposefully create them to neutralize pathogens like Bacteria and Virus. Environmental factors like pollution , radiation, cigarette smoking and herbicides as well as some industrial chemicals can also spasm free radicals. Their production, however multiplies several folds during pathological conditions.The most common oxygen containing free radicals like Hydroxyl radical, Superoxide anion radical, Hydrogen Peroxide ($H_2O_2$), Hydroxyl (HO), Peroxyl (ROO), alkoxy (RO) and Nitric Oxide (NO) are collectively called as Reactive Oxygen Species (ROS).

## Function of Free Radicals

As free radicals are unstable and highly reactive, they can either donate an electron to or accept an electron from other molecules, there by behaving as oxidants or reductants. They can cause the deterioration of plastics, the fading of paint, degradation of art work at our home. They are also capable of damaging biological relevant molecules in animal body like DNA, protein, carbohydrate and lipid leading to cell damage and homeostatic disruption. They are believed to have some patho-physiological role in aging of skin and several diseases like heart disease (Atherosclerosis), cataract, cognitive dysfunction, diabetic retinopathy, critical illness such as sepsis, acute respiratory distress syndrome, shock, chronic inflammatory diseases of the intestinal tract, organ dysfunction and even cancer.

## Antioxidants

To prevent free radical damage, the body has a defense system and the particular unit acts to nutralise these free radicals are called antioxidants. Body normally can handle the free radicals, when required amount of antioxidants are available. When free radical production becomes excessive, damage is inevitable.

The term antioxidants were originated to refer to a chemical that prevented the consumption of oxygen. In late 19$^{th}$ and early 20$^{th}$ century, extensive study was devoted to the uses of antioxidants in important industrial processes. Now it is understood to be a molecule stable enough to donate an electron to a rampaging free radical and neutralize it, thus reducing its capacity to damage the organs and system. These antioxidants delay or exhibit cellular damage mainly through their free radical scavenging property. These low molecular weight antioxidants can safely interact with free radicals and terminate the chain reaction before vital molecules are damaged.

## Sources of Antioxidants

Antioxidants are available chiefly from two different sources. Some antioxidants like Glutatheone, Ubiquinol, Uric acid etc. are produced during the normal body metabolism. Other lighter antioxidants are found in the diet. Although, there are several enzyme systems like Glutathione peroxidase, catalase, Super oxide dismutase etc. available in the body, that scavenge free radicals. The principal micronutrients providing antioxidants are Vitamin E ( a-tocopherol), Vitamin C (Ascorbic acid) and carotene. But our body normally can not manufacture these substances for which they must be supplied through the diet.

**Table-1** Food stuff containing antioxidants constituents

| FOOD STUFF | Constituents act as ANTIOXIDANTS |
|---|---|
| Citrus fruits, Black tea | Quercetin, Rutin, Hesperetin, Naringin |
| Tomato juice, Green tea | Kaempferol |
| Tomato juice, Vegetables | Fisetin, Myricetin |
| Propolis, Fruits | Galangin |
| Soyabean, Soa | Daidzin |
| Red clover | Biochanin A, Formononetin |
| Fruits,Vegetables | Cyanidin, Cyanin, Chrysin |
| Soyabeans | Genistein, Genistin |
| Tomato | Lycopene |
| Cruciferous vegetables | Isothiocyanate, Erucic acid |
| Green and Black tea | Catechin, Epicatechin, Epigallocatechin |
| Olive oil | 3, 4-Dihydroxyphenylethanol |
| Tulsi (Basil) | Eugenol, Nerol |
| Ginseng | Ginsenosides |
| Walnuts,Almonds | Oleic acid, Alphalinolenic acid, Anethol, Vitamin E. |
| Turmeric | Curcumin |
| Cloves | Eugenol. Cryophyllene |
| Fenugreek seeds | Diosgenin, Sapogenin |
| Rosemary | Carnosol |
| Mint (Pudina) | Menthofuran, Menthol |
| Garlic | Allyl sulfide |
| Cereals | Apigenin, Luteolin |
| Green and red chilli | Capaisin |
| Black pepper | Piperin, Piperidine, Piperatine |
| Cinamon | Eugenol, Phellandrene |
| Saffron | Crocetin |
| Ginger | Gingerol |
| Karela | Vicine, Momoridicine |
| Amla | Corilagin, Ellagic acid, Gallotanins |
| Saunf | Anethole |
| Shahtoot | Betulinic acid |
| Milk, Milk products | Casein, Vitamine D |
| Fish | Cord oil (Vitamin A) |
| Egg | Vitamin A |

## Plants as Source of Antioxidants

Many antioxidant compounds naturally occurring in plants have been identified as effective free radical scavengers. Strong antioxidant potential of Berries, Cherries, Citrus, Prumes, Olives, Black and green tea, different vegetables, spices, condiments and medicinal plants have been detected in research (Table-1).

Hence their consumption can not only provide the required nutrition to our body but also the potency to fight with the free radicals and prevent many a fatal disease and illness.

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# KNOW OUR PLANTS- NAGESWAR
## (*Mesua ferrea* Linn.)

**Samarendra Narayan Mallick**

## Introduction

*Mesua ferrea* Linn, the Sri Lankan ironwood, Indian rose chestnut, or cobra's saffron, is a species in the family Calophyllaceae a rare plant. It is the national plant of Sri Lanka and the state flower of Tripura, India. This slow growing tree is named after the heaviness and hardness of its timber. It is widely cultivated as an ornamental due to its graceful shape, greyish-green foliage with a beautiful pink to red flush of drooping young leaves, and large, fragrant white flowers. The generic name is after J. Mesue (777 - 857) and the specific epithet is from Latin meaning 'belonging to iron', in reference to its famed and very hard, durable timber. In Theravada Buddhism, this tree is said to have been used as the tree for achieving enlightenment, or Bodhi by four Lord Buddhas called "Mangala", "Sumana", "Revatha", and "Sobhitha".

## Distribution

*Mesua ferrea* Linn is widely and frequently distributed in the dense mountains of Eastern Himalayas, Bengal, Assam, Tenasserim Burma, Andamans, evergreen rainforests of Northern Kanara and southern part of Konkan, huge forests from Western ghats to southern Kanara to Tranvancore.

## Classification

Kingdom - Plantae

Order - Malpighiales

Family - Clusiaceae/Calophyllaceae

Genus - Mesua

Species - ferrea / M.ferrea

Full Name - Mesua ferrea Linn

Common Name- Eng: Cobra saffron, Ceylon ironwood, Indian rose chestnut, Hindi: Nag champa, Nagkesar, Odia-Nageswar, Bengali-Nageswar Tamil: Tadinangu, Naggappu, Assamese: Nokte, Malayalam: Vainavu, Telugu-Kesaramu

## Botany

The tree is medium sized to large evergreen tree. It can grow upto 30 meters tall with a small straight trunk, often buttressed at the base up to 2 meters in diameter. The bark of younger trees has an ash grey colour with flaky peelings, while of old trees the bark is dark ash-grey with a red-brown blaze. Leaves opposite, simple and entire, usually elliptical to narrowly elliptical, glabrous or occasionally glaucous. Leaves shiny with numerous secondary veins, looping, running parallel nearly to the margin, frequently with equally prominent reticulating tertiary veins. Sometimes with more or less persistent stipule-like interpetiolar modified leaves. The emerging young leaves are red to yellowish pink and drooping. The branches are slender, terete and glabrous. The bisexual flowers are 4 – 7.5 cm in diameter, with four white petals and a center of numerous orange yellow stamens. The fruit is an ovoid to globose capsule with 1 to 2 seeds. Flowers terminal or axillary, bisexual, solitary or in an up to 9-flowered open panicle, pedicel with small paired bracts. Sepals 4 decussate, sub orbicular, persistent and variously enlarged and thickened in fruit. Petals 4, white or pink. Stamens numerous, free or connate only at the base, ovary superior (1-2 celled) each cell with 1-2 axillary ovules. Style slender with a peltate to 4-lobed stigma. Fruit a capsule, usually globose, often beaked, thinly woody, usually dehiscing with (2 - 4) valves before falling, often exuding resinous droplets. One fruit contains 1-4 seeds.

**Fig.1:** Flower of Mesua ferrea

## Economic Parts and their Uses

Trees are cultivated for its flowers as they are highly attractive and ornamental in nature. Useful parts are fruits, seed, flowers, buds, leaves and bark. Mostly used part is stamens. As the English name indicates, the wood of this tree is very heavy, hard and strong. The density is 940 to 1,195 kg/m3 (59 to 75 lb/ft3) at 15% moisture content. The colour is deep dark red. It is hard to saw and is mainly used for railroad ties and heavy structural timber. In Sri Lanka the pillars of the 14th century Embekke Shrine near Kandy

are made of iron tree wood. The flowers, leaves, seeds and roots are used as herbal medicines in India, Malaysia, etc., and in Nag Champa incense sticks. In Assam, its seeds were also used for lighting purpose in evening for day to day purpose (while mustard oil for religious and health and culinary purposes) before the introduction of kerosene by the British. The plant is the sink for dust pollution.

It flowers during the dry season and flushes of new leaves are produced just after flowering at the start of the rainy season. The bisexual flowers open for one day, between 3 and 4 a.m. and closing around sunset.

## Phytochemistry

Plant is known to have glycosides, Flavanoids, xanthones, Triglycerides and resins. Important oils, Fatty acids some steroids, reducing sugar, tannin, saponin and some proteins are present in this plant. The genus is rich in secondary metabolites such as phenylcoumarins, xanthones and triterpenoides. An oil which is commonly called nahor can be extracted from the seed of the plant. It was also reported that form the seeds of *M.ferrea* 4-Phenylcoumarins such as mesuol, mesuagin, mammeisin and mesuone were isolated. Stamens can give a-sitosterol, biflavonoids mesuaferrones A & B euxanthone 7-methyl ether and other essential constituents. Seed oil is rich in oleic, stearic and palmitic acids.

**Fig-2** : *Fruits of M.ferrea*

**Fig-2 :** *Young tree of M. ferrea*

## Medicinal Uses

The plant has high medicinal value and used in inflammation as well as septic condition. It is used for its antiseptic, purgative, blood purifier, worm control, tonic properties etc by the tribal people of Assam. It is also used to cure fever, cold, asthma and can be useful as cardio tonic, expectorant, carminative, and antipyretic agent. Sore eye can be treated with the ashes of leaves of the plant. Kernels can be used in skin eruption problems. Leaves as well as flowers are used against snake and scorpion sting. Oil is used for skin infection, scabies, wounds and rheumatism. Leaves have been used in the form of poultice which can be applied to head in severe colds, also can be used in any kind of disturbance of stomach, cough, high perspiration, dyspepsia etc. Leaves are also used in treating scorpion strings. These flowers are highly expectorant, stomachic and astringent. Bark as well as root act as bitter tonic for the treatment of gastritis and

bronchitis. Powder of dried fruits and leaves mixed with ghee is used by the local communities of Bangladesh to get relief from burning sensation in hands and feet, joint pain and cold. Its flowers as well as its leaves have high and rich medicinal value and property and act as an antidote for dangerous snake bite. One of its biggest and vital applications is found on its flowers, as a paste of its flowers with mixture of butter and sugar is highly useful in treating and curing bleeding piles and burning of feet. Its seed oil can be beneficial for the cure of itch. Nagakeshara is one of the cathurjata. Seed oil is antirheumatic and used in skin diseases The plant is frequently used as antimicrobial, 3-6 antibacterial and antiprotozoal. This plant *Mesua ferrea* Linn is cytotoxic to T-lymphocyte leukemia cells and antimicrobial. also possesses anti-inflammatory and anti-ulcers along with central nervous system (CNS) depressant.

In India, it is used in a variety of Ayurvedic formulations (Brahma Ramayana and Chyawanprash) as an immunity booster agent. In Ayurveda, it is an essential and chief ingredient of Nagakeshara-adi-churna, used in curing bacillary dysentery and Naga-keshara yaga, in case of piles. In unani medicines it acts as an important ingredient of Jawarish Shehryaran, a liver tonic, Hab Pachuluna an appetizer. It acts as an anti convulsant also. Seizures can be cured by this plant. An Ayurvedic formulation (Maharisi amrit kalash-4) containing *M. ferrea* is traditionally used to treat cancer in India and neighbouring countries.

## Anti Ulcer Activity

Anti ulcer activity Xanthones also possesses antiulcer activity in albino rats by pyloric ligation method. Treated animals showed high ulceration, hemorrhage and perforation while pretreated animals showed scattered hyperemia and occasional hemorrhage.

## Antimicrobial Activity

Due to the presence of essential oils i.e. xanthenes and coumarines in the seed of the *M. ferrea,* this extract is useful in fighting and preventing emerging drug-resistance microorganism. Further the lipophilic extracted of *M. ferrea* Linn shows more activity towards gram positive bacteria.

## Antioxidant and Hepato-Protective Activity

Methanolic extract from dried flowers are used in experiment for antioxidant and hepato-protective activity. Drinking water is used for performing the artificial infection of S. aureus. There was increase in liver SOD (Super oxide dismutase) and AST (Alanine aminotransferase) in treated groups and reduction in seen is catalase, Glutathione reductase and glutathione peroxidise activity. Flower ethanolic extract shows inhibitory activity against nitric oxide assay. Its leaf extract shows inhibition to lipid peroxidation.

## Analgesic Activity

In an acetic acid-induced visceral pain mouse model, non-polar (n-hexane) fraction of *M. ferrea* leaf extract shows better

antinociceptive activity in terms of percent reduction in writhing response as compared with polar fractions (methanol and ethyl acetate).

## Diuretic Properties

Polyherbal combination (Draksharishta-T and - M) and its marketed formulation comprising of stamens of M. ferrea has been shown to induce significant diuretic, kaliuretic and natriuretic effects in the albino rats at the dose of 2.0 ml/kg over a period of 5 hours compared to the control group.

## Conclusion

*M. ferrea* is being used as sacred plant in India. It is used in various other parts of the world. It has special place in Ayurveda as the drug is useful for multisystem disorders and this drug proved to be the most used and consumed drug by domestic industries. The plant is known best for antioxidant, analgesic, anti-inflammatory, anti-tumor, antimicrobial and several other activities and properties. It acts as ingredient for Ayurvedic as well as unani medicines. Due to beautiful greenish crown, the plant is also used for garden decoration.As the plant is sacred, the flower is given to Lord Shiva. As it is a rare endangered plant species it should be conserved by planting in our gardens. Further studies on this plant should be carried out to explore some other important, necessary and unknown benefits.

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# PETROLEUM PLANTS

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## Introduction

Hydrocarbons are products of various plant species belonging to different families that convert substantial amount of photosynthetic products into latex. Latex producing plants are the families like Euphorbiaceae, Apocynaceae, Asclepiadaceae, Sapotaceae, Urticaceae and Convolvulaceae. The latex of such plants contain liquid hydrocarbons of high molecular weight. This hydrocarbon can be converted to high grade transportation fuels. These hydrocarbon producing plants are called petro plants and their crop is called petro crop. They are also known as petroleum plants. These plant hydrocarbons are about 10,000 Daltons in molecular weight. They are conversion products of photosynthesis.

Presence of liquid hydrocarbons in plants was first discovered in Euphorbia by M. Calvin in 1979.The biocrude obtained from petro plants are used as a substitute for conventional petroleum products. Petro plants can yield about 40-45 barrels of bio-crude per acre. About 2000 plant species all over the world have been screened for the presence of liquid hydrocarbons. Of these, 400 species are known to contain such liquid hydrocarbons.

**List of some common Petroplants**

| Plant Family | Botanical Name |
|---|---|
| Euphorbiaceae | Hevea brasilensis |
| | Euphorbia abyssinica |
| | Euphorbia resinifera |
| | Euphorbia tirucalli |
| | Euphorbia lathyris |
| Asclepediaceae | Calotropis procera |
| | Asclepias subulata |
| | Cryptostegia grandiflora |
| Asteraceae | Parthenium argentatum |
| | Taraxacum kok-saghyz |
| | Funtumia elastica |
| Apocynanceae | Landolphia heudelotii |
| | Landolphia owariensis |
| | Hardwickia pinnata |
| Fabaceae | Capaifera langsdorfii |
| | Capaifera multijuga |
| | Castilla elastica |
| Moraceae | Manihot glaziovii |
| | Ficus elastica |
| Dipterocarpaceae | Dipterocarpus turbinatus |
| Chlorophyta (Algae) | Botrycoccus sps |
| | Chlorella pyrenoidosa |

All these petro plants contain lactiferous canals in the bark and leaves. A milky or coloured juice called latex is found in the lactiferous canals.

The latex contains a mixture of resins, gums, hydrocarbons and some other substances. Petroplants belong to the family Euphorbiaceae, Asclepediaceae, asteraceae, Apocynanceae, Fabaceae, Moraceae, Myristicaceae, Dipterocarpaceae etc. some species of green algae also accumulate hydrocarbons in their biomass.

## Hydrocarbon Cracking

Breaking up of bigger hydrocarbons into much smaller ones of low boiling points is called hydrocarbon cracking. The latex rich in hydrocarbons is obtained by tapping process from tree species as in rubber tree or by extraction from stored biomass using organic

solvents. This extract rich in hydrocarbons is called bio-crude. From this bio-crude, crude oil, gasoline (petrol) and kerosene are manufactured by hydrocarbon cracking. Hydrocarbon cracking is done by heating the bio-crude under high pressure. It gives 10% natural gas, 44.6% gasoline, 22% kerosene, 22% crude oil and 1.4% solids.

In India, researches on petro-plants are going on in the National Botanical Research Institute (Lucknow) and Indian Institute of Petroleum ( Dehradun). New technologies have to be developed to produce biomass based petroleum products.

## Examples of Petro Plants

### 1. Hevea Rubber

Botanical name: Hevea brasiliensis

Family: Euphorbiaceae

The rubber plant *Hevea brasiliensis* is called Hevea rubber. It is widely distributed in South-East Asia. This is a good source of bio crude to make petroleum oils. However, it has not been used to get petroleum oils because of its best suitability for being used as rubber and no plant can be substituted for this rubber.

### 2. Euphorbia lathyris

Botanical name: *Euphorbia lathyris*

Family: Euphorbiaceae

Euphorbia is xerophytic plants. They belong to family Euphorbiaceae. Various species of Euphorbia such as *E.lathyris* and *E. tirucalli* accumulate hydrocarbons in their biomass. *Euphorbia lathyris* is an annual herb that can produce 20 tons old dry matter/ hectare in a year. This much of biomass can yield 10.6 barrels of crude extract to manufacture gasoline. The biocrude is extracted from the biomass using organic solvents such as ether and heptan. It is rich in terpenoids. Of the total volume of bio crude, 75% is converted into gasoline, 10% is converted into natural gas and the remaining 15% remains as solid matter during the cracking process.

### 3. Euphorbia tirucalli

Botanical name: *Euphorbia tirucalli*

Family: Euphorbiaceae

It is a hydrocarbon plant. It is also known as milk bush. It belongs to the family Euphorbiaceae. It has succulent stem with latex channels in the bark. It is growing on dry lands which are not suitable for other plants. The biomass of this plant is collected and

crushed with alcohol to extract liquid hydrocarbons. The extract is subjected to cracking process to get products equivalent to petroleum products. It is estimated that 10-15 barrels of gasoline can be obtained from the milk bush biomass/acre/year

**4. Calotropis procera**

Botanical name: *Calotropis procera*

Family: Euphorbiaceae

This is a shrub growing to a height of 1 to 2.5 meters. It is found as a weed in dry areas of India. Latex of this plant contains high proportion of the hydrocarbon hexane. This hexane contains 78% carbon, 12% hydrogen and 10% oxygen. Bio crude of *C. procera* yields petroleum oil similar to that of *E. lathyris*. Bio crude is extracted from this plant using organic solvents like ether and heptan. The bio crude on cracking yields 75% gasoline, 15% natural gas and 15% solid.

**5. Jatropha curcas**

Botanical name: *Jatropha curcas*

Family: Euphorbiaceae

It is a xerophytic shrub belonging to family Euphorbiaceae. It is growing in the tropical and subtropical regions of the world. It is an evergreen plant, growing up to the height of 20 feet. Its leaves are pale to dark green in colour. This plant yields 3.5 tons of seeds/ha/year. Seeds of *Jatropha curcas* contains 20% saturated fatty acids and 80% unsaturated fatty acids. They contain the poisonous substances such as Toxalbumin and Jatrophin. So, the seeds are poisonous. Seed of jatropha plant ia a good source of biodiesel. On crushing, the seeds yield 27-40% oil. When this oil is subjected to chemical treatment, it produces methyl ester.


## Social and economic advantages

Growers can sustain their own clean-fuel needs. Growers will have long-term sustainable income in emerging clean-fuel markets. Many oleaginous crops like Jatropha offer multiple profit centers through various by-products with commercial, industrial and cosmetic applications. The planting of agro-fuel crops that perform well in marginal soils allows for the use of unproductive land at little or no cost to the grower / green investor.

## Disadvantages

- Variation in quality of biodiesel
- Not suitable for use in low temperatures
- Food shortage
- Increased use of fertilizers
- Clogging in engine
- Regional suitability
- Water shortage
- Slight increase in nitrogen oxide emissions

## Conclusion

There is an increase in dependence on petroleum products and it imposes economical and social burdens on the development in future. So this is time for the development of substitute supplies of hydrocarbons. Efforts may also be required to increase the bio-crude potential of these species of plants through genetic manipulation. Therefore approach must be adopted to alleviate the scarcity of petroleum products as well as to create healthy environment.

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# HENRY GWYN JEFFREYS MOSELEY

## (THE DISCOVERY OF THE INFALLIBLE LAW OF NATURE)

**P.K.Pujapanda[1]**
**Balaram Sahoo[2]**

"Let it suffice to say that your son died the death of a hero, sticking to his post to the last. He was shot through the head, and death must have been instantaneous. In him the brigade has lost a remarkably capable Signalling Officer and a good friend; to him his work always came first, and he never let the smallest detail pass unnoticed." … These were the lines written by a fellow soldier to the mother of Henry Moseley, the man who discovered that atomic number - the number of protons in the nucleus of an atom of an element is the key to the periodic arrangement of elements in the periodic table of Mendeleev instead of atomic weights originally postulated by its author.

When the 1st World War broke out in Western Europe, Moseley left behind his research at the University of Oxford to volunteer his services for the Royal Engineers of the British Army. Moseley was assigned to the force of British Empire soldiers that invaded the region of Gallipoli, Turkey in April 1915 as a Telecommunication Officer. Mosley was shot and killed during the battle of Gallipoli on 10$^{th}$ August, 1915 at the age of 27.

Moseley was known to his friends as Harry. He was born on 23$^{rd}$ November, 1887 at Wemouth Dorset, England. His father Henry

Nottidge Moseley (1844-91) was a biologist and also a Professor of Anatomy and Physiology at the University of Oxford. His mother was Amabel Gwyn Jeffreys Moseley. When Moseley was five years old his father died. The upbringing and education of the child was now the responsibility of his mother who was a determined lady and took all pain to give him good education. Henry was a promising school boy with indomitable spirit at the Summer Fields School. He performed very well at the school which enabled him to enter Eton College on King's Scholarship at the age of thirteen. In 1906, he won the chemistry and physics prize at Eton.

In 1906, Moseley entered Trinity College of the University of Oxford with Millard scholarship in natural science. He earned his Bachelor's degree in the year 1910. Soon after his graduation, he joined as a demonstrator in physics at the University of Manchester and worked under the supervision of the great teacher Sir Ernst Rutherford. For some time he underwent rigorous training in both experimental and theoretical physics. That was the period when the mystery of the atom was hot on the trail and occupied the brilliant minds.

Moseley's first research work was concerned with the determination of time period of emanation of actinium which he investigated with the young physicist Kasimir Fajans of Germany. Emanation of actinium produced a radioactive element of very short half-life of nearly 1/500 of a second. Moseley and Fajans published their first work in the Philosophical Magazine in 1911.

In June 1912, news emerged that Max von Laue of the Zurich University had discovered that crystals when exposed to X-rays, the crystals split up X-rays like a diffraction grating and produced an X-ray spectrum which earned him Nobel Prize in Physics for the year 1914. Soon Professor William Bragg of Leeds University and his son William Lawrence Bragg at Trinity College developed a method which enabled them to determine the inner structure of crystals. X-rays were passed through thin sections of crystals and then photographed. They found that crystals were made up of regularly arranged rows of atoms. Using mathematical calculations Braggs developed a true pattern of arrangement of atoms in crystals in three dimensions. This method is now regarded as the foundation of modern concept of crystal structure by X-ray analysis. William Henry Bragg and William Lawrence Bragg shared the Nobel Prize in Physics in 1915 for their monumental work.

In the mean time Charles G. Barkla of the University of London discovered a very astounding atomic phenomenon. He observed that when electrons in a Crooks tube were allowed to strike the anticathode made of different elements, they produce X-rays of different penetrating power. He examined the penetrating power of the X-rays using thin sheets of aluminium foils. This contribution earned him Nobel Prize in Physics in 1917.

A major point of contention in the periodic table of Mendeleev was regarding the precise ordering of the elements that concerned the atomic weights. In 1913, the Dutch amateur, Anton von de Broek, a theoretical physicist suggested the ordering principle lay instead in the nuclear charge of each atom.

Moseley was keenly following these works. In 1913, using Braggs X-ray spectrometer method he took photographs of the X-rays of different elements. From the very beginning he had the confidence of the importance of his research and was determined to find the electric charge of the nucleus of each atom. His experimental approach shows his genius. He fixed a metal plate as the anode of a Crooks tube. It acted as the target where stream of electrons generated at the cathode bombard the anticathode, excited the metal to produce the characteristic X-rays. The rays were then allowed to fall on a narrow beam on a crystal mounted on the table of a spectroscope. The reflected rays were then photographed. Within six months, he examined the X-ray spectra of thirty eight elements from aluminium atomic number 13 to gold atomic number 79. He examined the results of his experiments. Different elements gave rise to different wave lengths. He found that heavier elements gave rise to shorter wave lengths.

He plotted on a graph paper the inverse square root of the X-ray wave lengths of the elements against the number of the element exactly arranged as in the Mendeleev's periodic table. He obtained a straight line exactly in order of the atomic masses. What did the experimental result reveal? It rang in the mind of Moseley that nature has revealed itself a profound, fundamental and infallible law that there is a quantity which increases in regular steps while moving from one element to the next. The quantity represents the positive charge or the number of protons in the nucleus of the atom of the element. This was the most fundamental discovery of this brilliant experimenter and philosopher of science. He published his result "the law of atomic number" in 1913.

Henry Moseley

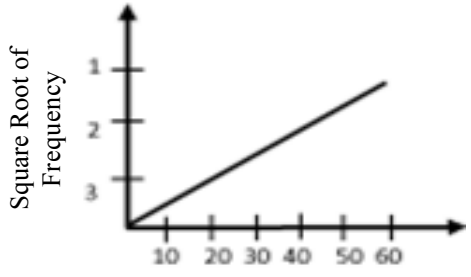


Figure-1

Moseley rewrote the periodic table of elements of Mendeleev arranging the elements in increasing order of atomic numbers beginning from hydrogen atomic number 1 to uranium atomic number 92. From this extraordinary youth, the world received an

unerring road map of all the elements the Universe contained. Mendeleev had given mankind a romantic photogram of the elements in the year 1869. Now the world received a permanent structure which has sustained itself unchanged and unchallenged.

In the periodic table prepared by Moseley in order of atomic number of elements, the position of a few pairs of elements, namely potassium and argon, cobalt and nickel, and iodine and tellurium were reversed. The reversal caused the elements to fall into groups of elements with similar chemical properties which brought harmony into the classification of elements.

Mendeleev had confronted with the problem of rare earths, fifteen elements between barium and tantalum namely lanthanum, cerium, praseodymium, neodymium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, and lutecium which possessed properties very similar to each other and offered great difficulties in their separation. The rare earths posed the most baffling problem in their position and accommodation in the periodic table of Mendeleev. Moseley solved the mystery of these elements lanthanum to lutecium by assigning atomic number 57 to 71. X-ray spectra of rare earths settled the problem of rare earths at once demonstrating a remarkable achievement of Moseley.

Moseley's table had vacancies for seven elements of atomic numbers 43, 61, 72, 75, 85, 87, and 91. They were later discovered and their atomic numbers determined by X-ray spectra.

Otto Hahn and Lise Meitner discovered element number 91 in Berlin and named it protactinium. The pure metal was isolated by Aristid V. Grosse of Germany in the year 1934. In 1923, George von Veresey and Dirk Coster working in the laboratory of Bohr in Copenhagen discovered hafnium, element No.72 in an ore of zirconium. In 1937, element No. 43 was discovered in an atomic reactor at Berkeley by Carlo Perrier Emilio Segree and B.N. Cacciapuote. In1939, Mille Marguerite Perey discovered francium atomic number 87 at the Radium Institute in Paris. In 1940, Segree and his co-workers obtained astatine, atomic number 85 at the University of California. J.A. Marinsky and L.E. Gledenin working with C.D. Coryel reported the discovery of promethium atomic number 61 in atomic reactor experiments. In 1925, Walter Noddack and Ida Tacke of Berlin reported rhenium atomic number 75.

In his intellectual perception, Moseley once declared that the periodic table ends with uranium, atomic number 92. He did not envision that three decades hence man will achieve such technological excellence that he will synthesise here on earth new elements not found terrestrially. Beyond uranium, 26 elements with atomic numbers 93 to 118 have been artificially made by man and all these elements have been placed in Mendeleev's periodic table in order of their respective atomic numbers.

Had not the Turkish bullet cut short the life of young Moseley, he could have seen the stir in human mind to see the inner world of

the atom and has become rich in knowledge. Grief stricken Robert Millikan wrote: "In a research which is destined to rank as one of the dozen most brilliant in conception, skilful in execution, and illuminating in results is the history of science, a young man twenty six years old threw open the windows through which we can glimpse the sub-atomic world with a definiteness and certainty never dreamed of before. Had the European war had no other results than the snuffing out this young life, that alone would make one of the most hideous and most irreparable crimes in history."

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## Engineers Day

15th September is celebrated as the Engineers Day in India to recognise the contribution of engineers in the development of the nation. It is the birthday of Mokshagundam Visvesvaraya, a scholar, statesman, educationist and the most celebrated engineer in India. Visvesvaraya was responsible for the construction of Krishna Raja Sagara Dam in Mysore. He was the chief engineer in the project. He was also the chief designer of the flood protection system of Hyderabad. He also designed and patented the automatic weir floodgates, which were first installed at the Khadakwasla reservoir in Pune in 1903. He was involved in many irrigation and water supply projects in India. He had transformed Mysore into a 'model state' of the India. For his achievements he was awarded a *Bharta Ratna* in 1955. He was also awarded the British Knighthood by King George V.

# IMPORTANCE OF SOIL HEALTH CARD

**Prava Kiran Dash[1]**
**Dr.Antaryami Mishra[2]**
**Dr.Subhashis Saren[3]**
**TupakiLokya[4]**

Despite success of green revolution, India still houses one-fourth of the world's hungry and poor and 40% of the world's malnourished children and women. Despite national food surpluses, wide spread poverty and hunger remain because the growth of agriculture and the national economy have not adequately benefited the poor. Policy reform alone will not be enough to increase agricultural growth and to make it more equitable. The policy reforms must be accompanied by appropriate and efficient agricultural research and extension. The human population of India is estimated to increase to 1.6 billion in 2050 from the current level of 1.2 billion and the food grain production would need to be raised to 581 million tonnes from the present level of 241 million tonnes (Ghosh, 2013). This additional food requirement will have to be produced from the projected cultivable land of 142 million hectares (Kathpalia and Kapoor, 2011). However, the fact that per capita land holding will go down to an abysmally low 0.087 ha, poses a grave concern (Sharma, 2006).

Degradation of natural resources and public concern over environmental issues, are shifting research priorities and funding toward broader issues, such as land, water, forests, and biodiversity; pesticide safety, and residue

minimization; livestock waste management; water quality preservation; and watershed protection. Success in meeting these challenges requires sharply increased skills and higher investments in research on natural resources management (NRM), social sciences, and environmental issues. Vulnerability to climate change has emerged as a serious issue. Another issue affecting the productivity is the rampant encroachment of prime agricultural lands from competing sectors.With hardly any scope of horizontal expansion of land area, effective land resource conservation and proper land use planning become indispensable. This necessitates generation of information on nature and extent of soils. Land Resource Inventory, using high resolution remote sensing data provides such information on land properties, which when integrated to practical field data can lead to development of large scale spatial models for nutrient demand forecasting and nutrient scheduling.

Developing soil health cards includes designing sampling scheme, soil sample collection, analysis of soil health parameters in the laboratory, developing surface of differentparameters, using GIS technique, attaching the surface layer with the cadastral information and finally farmer/plot wise information on soil health parameters (NBSS & LUP, 2015).

The soil health card evaluates the health or quality of a soil as a function of its characteristics, plant and other biological properties. The card is a tool to help the farmer to monitor and improve soil health based on their own field experience and working knowledge of their soils. Regular use will allow them to record long term trends in soil health and to assess the effects of different soil management practices. It provides a qualitative assessment of soil health. Its purpose is to use indicators that assess each soil's ability to support crop production within its capabilities and site limitations. The card, which will carry crop-wise recommendation of fertilizers required for farm lands, will help farmers identify health of soil and judiciously use soil nutrients. Farmer wise/ land parcel wise soil health card with the information consisting of slope, erosion, soil depth, colour, texture, organic carbon, pH, electrical conductivity, macro and micro-nutrients, degradation type, etc. can guide the farmers, planners and executors for selecting right land use, right agro-techniques on well-defined parcel of land.

Soil Health Card Scheme was launched in February, 2015 by Government of India. The scheme envisages the GPS-enabled soil sampling at a grid of 2.5 ha in irrigated areas and 10 ha in rain fed areas, and issue of Soil Health Cards (SHC) to all farmers of the nation (Dwivedi*et al.,* 2015). SHC is a printed report that a farmer will be handed over for each of his holdings. It contains the status of his soil with respect to 12 parameters, namely N, P, K (Macro-nutrients); S (Secondary-nutrient) ; Zn, Fe, Cu, Mn, B (Micro - nutrients); and pH, EC, OC (chemical parameters).

SHCs are provided by the Soil Testing Laboratories (STL) present in different states.

At national level, an online SHC portal has been created by DACFW with the help of National Informatics Centre (NIC) wherein entire information related to soil sampling and soil testing will be uploaded. The SHCs will then be automatically generated through the portal. The scheme also includes training / refresher courses for the STL staff, field demonstrations on soil test based fertilizer use, and awareness programmes for the farmers.

SHC for a farm will be made available once in a cycle of 3 years, which will indicate the status of soil health of a farmer's holding for that particular period. Subsequently, the SHCs will be renewed at an interval of 3 years. The SHC given in the next cycle of 3 years will be able to record the changes in the soil health for that subsequent period.

The results of soil testing are analysed by the experts. The results are related to the strength and weaknesses (soil related crop production constraints) of the soil. The card contains an advisory based on the soil nutrient status of a farmer's holding. It will show recommendations on dosage of different nutrients needed. The experts also suggest methods to improve the soil quality. These results and suggestions are displayed in the soil health cards. The farmers will be guided by experts to come up with solutions to improve the quality of the soil. Further, it will advise the farmer on the fertilizers and their quantities he should apply, and also the soil amendments that he should undertake, so as to realize optimal yields. Soil Health Cards with the farmers will serve as a great potential to achieve the goals of balanced fertilization and maintenance of soil health.

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# QUIZ : MOTION & FORCE

**Sri Binod Chandra Jena**

1. What is the density of Ice ?
   a) 1000 kg/m$^3$
   b) 920 kg/m$^3$
   c) 720 kg/m$^3$
   d) 550 kg/m$^3$

2. What is the density of Petrol?
   a) 500 kg/m$^3$ b) 600 kg/m$^3$
   c) 700 kg/m$^3$ d) 800 kg/m$^3$

3. An Aluminum block having density 2.7 gm/cm$^3$ has a mass of 2700 kg. What is its volume?
   a) 4 m$^3$ b) 3 m$^3$
   c) 2 m$^3$ d) 1 m$^3$

4. A measuring cylinder contains 40 ml. water. When a stone of mass 50 gm. is lowered into the measuring cylinder, the water level rises to 60 ml. What is the density of stone?
   a) 2.5 g/cm$^3$ b) 25 g/cm$^3$
   c) 35 g/cm$^3$ d) 1.5 g/cm$^3$

5. A stone of mass 40 gm has a volume 20cm$^3$, what is its relative density?
   a) 0.5 b) 1.5
   c) 2.0 d) 2.5

6. When water is heated from $0^0$ C to $4^0$, what will happen to its density?
   a) Decreases
   b) Increases
   c) Remains same
   d) Cannot ascertain

7. Which current is formed through an Air Conditioner?
   a) Transformation
   b) Transmission
   c) Conduction
   d) Convection

8. In which apparatus the density of sugar in a liquid can be measured?
   a) Saccharometer
   b) Lactometer
   c) Hydrometer
   d) Alcoholmeter

9. The density of silver in CGS system is 10.5. What is its density in SI system?
   a) 10500 kg/m$^3$ b) 1.05 kg/m$^3$
   c) 1050 kg/m$^3$ d) 105 kg/m$^3$

10. What is the approximate value of 1 kg force?
    a) 9 N b) 10 N
    c) 90 N d) 100 N

11. What type of motion occurs when a coin moves undeflected over a carrom board?
    a) Curvilinear b) Rotatory
    c) Linear d) Vibrotory

12. What type of motion does the piston of an engine possess?
    a) Cicular b) Linear
    c) Curvilinear d) Oscillatory

13. What type of motion is associated with a bullet fired from a gun?
    a) Translatory b) Rotatory
    c) Oscillatory d) Vibratory

14. What is the motion exihibited by a car moving on a busy road?
    a) Periodic b) Non-Periodic
    c) Multiple d) Random

15. What type of motion occurs when a mosquito flies?
    a) Rolling b) Multiple
    c) Zigzag d) Circular

16. What type of motion occurs when a cricket ball moves?
    a) Multiple b) Circular
    c) Zigzag d) Rolling

17. A boy travels 12 m from A to B due North and then 5 m due East from B to C. What will be the displacement from A to C?
    a) 13 m b) 7 m
    c) 17 m d) 6 m

18. A person walks 4 m towards the North and returns 5 m towards the South, what will be his displacement?
    a) 9 m b) -1 m
    c) +1 m d) 0

19. What is the quantity of 1 light year?
    a) $9.4605284 \times 10^{12}$ m
    b) $9.4605284 \times 10^{13}$ m
    c) $9.4605284 \times 10^{15}$ m
    d) $9.4605284 \times 10^{16}$ m

20. A boy covers a distance of 60 m in 2 min., what is the speed of the boy?
    a) 2 m/s b) 1 m/s
    c) 1.5 m/s d) 0.5 m/s

21. A train takes 4 hours to travel from station A to station B and another 6 hours to return from station B to station A. The distance between station A and station B is 500 kms., What is its average speed?
    a) 100 m/h b) 150 m/h
    c) 250 m/h d) 500 m/h

22. A car starts from rest and attains a velocity of 20 m./sec over a time perioid of 10 s, what is the acceleration of the car?
    a) 1 $m/s^2$ b) 2 $m/s^2$
    c) 20 $m/s^2$ d) 200 $m/s^2$

23. A man comes by a cycle without putting brake from hilly station downwards on a road. What happens to the acceleration?
    a) Remixes constant
    b) Decreases
    c) Increases
    d) Can't asseration

24. What is the acceleration due to gravity on the moon's surface?
    a) 16.3 $m/s^2$ b) 1.63 $m/s^2$
    c) 13.6 $m/s^2$ d) 1.36 $m/s^2$

25. A body weighs 60.6 kgs on the surface of Earth. What will be its weight on the surface of the moon?
    a) 6.06 kg b) 66 kg
    c) 1.04 kg d) 10.1 kg

**ANSWER**

| | | | | |
|---|---|---|---|---|
| 01. (b) | 02. (c) | 03. (d) | 04. (a) | 05. (c) |
| 06. (b) | 07. (d) | 08. (a) | 09. (a) | 10. (b) |
| 11. (c) | 12. (d) | 13. (a) | 14. (b) | 15. (c) |
| 16. (d) | 17. (a) | 18. (b) | 19. (c) | 20. (d) |
| 21. (a) | 22. (b) | 23. (c) | 24. (b) | 25. (d) |

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# RECENT NEWS ON SCIENCE & TECHNOLOGY

## First Woman President of INSA

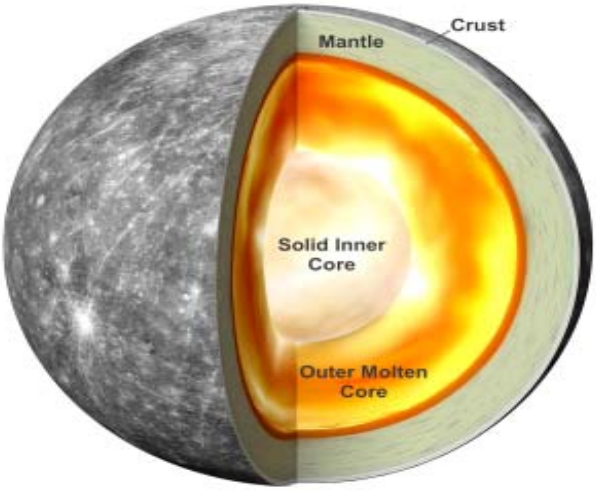
Biologist Chandrima Shaha has been elected President of Indian National Science Academy (INSA) and will assume office on January, 2020. INSA was established in January 1935 to promote science in India and harness scientific knowledge to benefit humanity and nation. In its 85 years of existence, the Academy has never had a woman president, but Chandrima Shaha broke the bar. She was first elected to INSA in 2008 and served as its Vice President between 2016 and 2018. She specialises in cell biology and has conducted extensive research on the 'Leishmania' parasite which causes Kala Azar. She is currently Professor of Eminence at the National Institute of Immunology, New Delhi.

Chandrima Shaha

## Mercury has a massive inner care

It was earlier known that Mercury's core was huge, taking up about 85 percent of the planet's total volume. It was also known that the planet has a weak magnetic field generated by circulation of molten metal in its liquid core. But it was not clear if Mercury, like Earth, also has a solid core.

But, now from the data collected by MESSENGER mission, it is found that Mercury has a massive solid inner core about 2000 kilometres in diameter, making up of about half of its entire core. Although MESSENGER ended its mission in 2015, the data collected by it on the spin and gravity of Mercury is still being analysed and new findings are coming out.




Structure of Mercury

## Marsquake detected

For the first time NASA's robotic probe Insight Lander has detected a seismological tremor on Mars on 6 April, 2019. It was a natural trembling from the Mars interior. It is the first seismic activity recorded on a planetary body outside of the earth or the moon.

Insight Lander was dropped on the surface of Mars in November, 2018. This robotic Lander has been designed to study the deep interior of Mars. The magnitude of the Marsquake was between 2 to 2.5 on the Richter scale which appear to be coming from the inside of the planet. Earthquakes are caused by sudden tectonic movements in the earth's crust. Mars does not have tectonic plates, but still experienced a quake.

Scientists are still studying the data to know the exact cause of the seismic signal. Researchers suggest that the continuous process of cooling and contraction creates the stress which eventually becomes strong enough to crack the crust and causes disturbances on the surface.

## High-temperature Superconductor

Scientists have theoretically calculated that a superconductor could work up to about 200°C. It is a compound of hydrogen, magnesium and lithium. If this prediction is confirmed experimentally, it would create a sensation in superconducting field, because all other known superconductors must be cooled below room temperature to work. Requirement of cooling makes them difficult to use. So physicists are on a quest to find superconductors that can stand the heat, which could save vast amount of energy. The newly predicted superconductor, however, comes with some complications. It must be squeezed to extremely high pressure, nearly 2.5 million times the atmospheric pressure. This has been reported by physicist Hanyu Liu and colleagues of Jilin University in Changchiun, China in the August, 30 *Physical Review Letters*.

## Amazon Fire

The Amazon rainforest in Brazil is being ravaged by fire. More than 74,000 fires have burned in the country since January, according to the country's National Institute for Space Research. 9,500 new forest fires have ignited since just last week, the result of the natural dry season and fires intentionally ignited to clear forest. Black smoke billows from treetops, spreading across parts of South America and even shrouding the coastal city of São Paulo in near darkness.

The fires, along with concerns about biodiversity and climate change, have triggered global alarm. Tropical forests, as a whole, contain about half of the world's land-based biodiversity, and the Amazon is a big chunk of that. So when the Amazon rainforest is burnt down, we lose species, habitats and the lands that belong to indigenous communities for millennia.

Globally, about 10 to 15 percent of our $CO_2$ emissions comes from deforestation. If this is going back up again in Brazil, it may make climate change even worse. It's erasing a decade or two worth of progress. It's a big problem for the world in terms of climate change. It's a huge problem for people locally and regionally who are dependent on the forest and have preserved them for millennia. It's just a huge tragedy.

Compiled by
EDITOR

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3. The authors are requested to write clearly on one side of A/4 size paper. The relevant pictures in 4cm X 6 cm size are welcome. Photo copies of manuscripts are not accepted for consideration.
4. Each article will be ordinarily of two to three printed pages in A/4 size papers.
5. The article shall be profusely illustrated with pictures.
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8. Matter translated from other languages and illustrations should indicate the original sources otherwise those would not be accepted. The articles which are not published, can not be returned to the authors.
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10. The writers should present difficult concepts of science through stories of everyday life, heart-rendering songs, pictures, satirical cartoons or attractive dramas.
11. All units in the articles should be given in the metric system.
12. The title of the article should be brief and attractive. Moreover, subtitles may be given in long articles. The writings should be coherent and cohesive.
13. There should not be repetition of specific words. While ensuring the contemporary spirit of the writing, it should reflect some valuable lesson for the society. It is also necessary to avoid mistakes in spelling, language use and factual details.
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