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The Cover Page depicts : *Adolescence : An age of Opportunity*

Cover Design : *Sanatan Rout*

EDITORIAL

ADOLESCENCE : AN AGE OF OPPORTUNITY



Adolescence is a transitional phase of human life which falls within the range of ten and twenty four years. It is the period of life when a child develops into an adult : the period from puberty to maturity, a time of rapid growth and development with inconsistent changes that varies widely among individuals. However, the physical, psychosocial and cognitive changes that occur during adolescence start earlier, during preteen years (ages 9 to 12) and end later. It is also a time of risk and vulnerability, and of peak growth and potential. The young people who are already vulnerable offline seem to experience higher negative effects of life from the online digital world.

Raised in the glow of digital device, teenagers today are depressed, anxious, hopelessly distracted, mentally ill, socially isolated. They grow up rather in a different world. Issues like family conflict, childhood trauma, poverty, exposure to violence, easy access to alcohol, drugs and narcotics etc. have significant influence on teenage psychology to amplify risks among already vulnerable adolescents.

But adolescence is not always linked with the negative aspects of life. This is also an age of opportunities. The brain during adolescence is very malleable and has a heightened capacity to change in response to experiences. It works as a double edged sword. On the one hand, the brain is susceptible to toxic experiences that can cause harm, but on the other hand, that is also susceptible to all positive influences. Adolescence can be taken as an age of opportunity for joy and well being of the future adult. The health, education and physical/psychological/emotional well-being in adolescence set the trajectory for the rest of a person's life. Today's teenagers are projected to make up the largest cohort in human history. Worldwide more than 1.2 billion are adolescents (as per March 2015 data). They are the future of the nation, forming a major demographic and economic force. Therefore, it is pertinent to know the different aspects of that phase of life where the future of humanity rests.

Biologically adolescence can be a physical stage of transition marked by the onset of puberty and the termination of physical growth. Adolescents acquire many cognitive abilities to think abstractly and multi-dimensionally and to prepare socially adult roles. Major biological changes during this phase of life include, changes in sexual character, height, weight, body mass and in the structure and organization of brain. These changes are largely influenced by increased secretion of hormones which trigger both physical and behavioral changes.

In adolescent brain the Prefrontal Cortex (PFC) is not fully developed until the mid twenties. So teenagers might rely on amygdala (a part of the emotional brain or limbic system) to make decisions and solve problems more than adults do. The amygdala is associated with emotions, impulses, aggression, fear and instinctive behavior. The PFC which gets fully developed with the attainment of adulthood is concerned with a variety of complex cognitive behaviors, including planning, personality development, personality expression, moderating social behavior and decision making. All these attributes are not perfectly developed in adolescence. Further, a maturational imbalance between development of the socio-emotional system and cognitive control system in the brain contribute to impulsivity and other behaviors characteristic of adolescence. Teen age brain has high degree of plasticity and flexible neural connections that help them adjust to new environment and adapt more easily than adults. But this very quality of easy adaptability makes them vulnerable. However, high levels of self-awareness and self-control during mid adolescence will lead to better decisions during the transition to adulthood. Environment plays an important role in establishing identity among adolescents. Adolescents with less privileged upbringing have a more difficult time establishing their identity.

Our knowledge about adolescence exposes our inadequacy by revealing how we need to alter our policies and practices, the parental behavior and societal attitude towards this most vulnerable group of our society.

Now, the time has come when science, medicine, policy makers and the society as a whole who have often paid more attention on childhood and adulthood, should also focus on the years in between, for the better prospect of the future generation. Investments in today's teenagers in matters of resources, provisions and policies for their health, education, growth and emotional development would yield great dividends for both the current and future generations.

In this context, researchers agree that the role of each and every strata of the society including industrialists, religious leaders, government policy makers, judiciary, civil society, health and educational institutions, teachers, family members etc. is very vital. We need to understand why good kids often do ill-advised activities. Our model behavior and caring attitude towards them will make a great change in the life of adolescent. They need our care, affection, warmth and support but not the other way round to lead a successful adult life.

Prof. Tarani Charan Kara
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INTERNET



Er. Mayadhar Swain

The present time is often called the age of Information Technology. Information or data are being transmitted from one place to another very quickly. The chief architect of information technology is computer. Although the computer was initially developed for fast counting, gradually it has been developed to do a lot of different types of works. Internet is one of the applications of computer.

What is Internet?

Many people use the word 'internet' to mean going online. But it has a widespread meaning. The internet is a global network connecting millions of stand-alone computers. The connections between the computers are through copper cables, fiber-optic cables (which send messages in pulses of light), wireless radio connections (which transmit data by radio waves) or satellite links.

History of Internet

Two computers communicated with each other for the first time on 2 September 1969. Message was sent from computer to computer in different locations on 29 October 1969. ARPANET of the USA adopted the standard TCP/IP protocol to connect many computers on 1 January 1983 and from there researcher began to assemble the "network of networks" that became the modern internet.

What does internet do?

The internet simply moves computerized information (known as data) from one place to another. Its job is somewhat similar to the postal services. Postal services carry the letters from one place to another, no matter who they are from or what messages they contain. The same thing applies to internet. But the difference is that data is sent through the internet almost instantly. The internet carries extensive range of data and services such as inter-linked hypertext documents and applications of the world wide web, electronic mail, user-net news groups, telephony, peer-to-peer networks for file sharing, chat messages and many more. All data are handled equally and passed on in exactly the same way.

Movement of Data in Internet

Data movements over the internet take place by a method called packet switching. To understand packet switching, let us first discuss its predecessor circuit switching. Telephone works on circuit switching method. When I ring my friend over phone my telephone opens a direct connection (or circuit) between my home and to that of my friend. As long as we are on the phone, the circuit remains permanently open between our two phones. This way of linking phones together is called circuit switching. This is done automatically by an electronic telephone exchange.

Initially the internet was working on circuit switching method. But it faced many

problems. All the time I am connected to my friend over phone, no-one else can get through to either of us by phone. If we talk very slowly or go off to do some work by hanging the telephone set, the circuit is still connected and no one can use the line during that time.

If the internet works on circuit switching, the time to send messages or mail will be more. To avoid this, it adopted the system of packet switching. In this method, the information is broken up into pieces called packets. Suppose I send an email to my friend in Canada. Instead of opening up a long circuit between my home and Canada and sending the email all in one go, the email is broken into packets. Each packet is tagged with its ultimate destination and allowed to travel separately. Theoretically, the entire packet can even travel by totally different routes. When they reach their ultimate destination, they are reassembled to make an email again.

Packet switching is much more efficient than circuit switching. In packet switching, permanent connection between the two places that are communicating is not required so that it does not block other information to pass at that time. Many people can use the network at the same time. Since the packets or pieces of information can flow by different routes, they choose the routes which are shortest or quietest. This way internet works efficiently with shortest possible time.

Some Terms in Internet

In internet, many terms are used. Some are more familiar and some are difficult to understand. Some of the terms are explained here.

1. Server

There are hundreds of millions of computers connected to the internet and all the computers do not exactly do the same thing. Some of them store information and pass it on when requested. These machines are called Servers. Servers are of different types depending on the nature of jobs done by them. Machines that store ordinary documents are called file server and those hold people's mail are called mail servers. Similarly the machines that hold web pages are called web servers. There are tens of millions of servers on the internet.

2. Client

A computer that gets information from a server is called a client. When we connect our computer to a mail server to read our messages, our computer is called the client.

3. Peer-to-peer Communication

When two computers on the internet swap data back and forth on almost equal basis, they are known as peers. The machines involved here sometimes act

as clients and sometimes as servers. Chatting between two friends through computers is an example of peer-to-peer communication.

4. **Routers**

Apart from servers and clients, there are some other computers called routers connected to the internet. Their job is to make connections between different systems. For example, when we have several computers in our office, these are connected to the internet via a single router.

5. **Internet Protocol**

In internet too much data flows each day by packet-sharing. Some type of control is necessary so that vast mass of data reach its destination without getting lost. This control is done by internet protocol (IP). Actually it is the address of a particular computer in the internet just like our home address in our town is required for our postal letters to reach us by post man. IP address takes the form of a series of digits separated by dots or colons. So if all the machines have IP addresses, every machine knows exactly how and where to contact every other machine.

6. **Transmission Control Protocol**

Transmission Control Protocol (TCP) is a control system of the internet. It

sorts out how packets of data move back and forth between one computer and another. It is responsible for the transmission of data from source to destination. It arranges the data to be broken into packets, transmitted and reassembled into the correct order at the receiving end.

7. **Email**

Email or electronic mail is similar to our postal mail. In postal mail, one person drops a letter on post box, the post man sorts out the letter and sends it through various modes to the destination which is identified in his address. Similarly, in emails, the sender sends it through his computer to the server and then the server transmits it to destination identified by the person's email address. It is very fast. The email address has some special characters. It is written as the name of person followed by special symbols and then followed by the service providers name. For example, my email address is *mayadhar2002@yahoo.co.in* and that of Odisha Bigyan Academy is *odishabigyanacademy1@gmail.com*. After the entry of email, the number of letters in postal services has been reduced drastically. Along with message, we can attach photos and documents also in the email.

8. World Wide Web

The world wide web (www) is the worldwide collection of text pages, digital photographs, music files, videos and animations which can be accessed via the internet. It has become known simply as Web. The basic building blocks of the web are text pages, which are called web pages. These are formatted and written in a special way called Hyper Text Markup Language (HTML). A collection of web pages on the same computer is called website. The web pages may have highlighted phrases called links or hypertext links on it. Clicking one of these takes us to another page on this website or another website entirely.

The British Computer Scientist Tim Berners -Lee invented the World Wide Web in 1990, about 20 years after the invention of internet. At the time he was working as a software engineer at CERN, the large particle physics laboratory near Geneva, Switzerland.

With the help of World Wide Web, we are able to access thousands of books and other information stored by someone in his website. The materials are stored in his computer called server and these are publicly accessible. Each website has a domain name. The domain name is simply a friendly

address and when we type it on the computer, it is automatically redirected to the correct address. For example, the domain name of Odisha Bigyan Academy is *www.orissabigyanacademy.nic.in*.

Conclusion

The internet is about 40 years old and has become a huge success. Now we have reached digital age and almost all works including commerce, governance and financial transactions are done digitally via internet. The email has already replaced the hundred year old telegraph system. The postal system is also being threatened. The World Wide Web has made the internet most popular. Books are now printed digitally and are called ebooks. The famous Britannica Encyclopedia has stopped its annual printing; instead it is now digitally available. People have now stopped going to library as most of the books and information are freely available in the web.

According to Internet World Statistics, as of 30 June 2017, there is an estimated 3885 million (51% of world population) internet users worldwide and the number is being increased rapidly. In India, the figure is 462 million (34.4% of the population) and it is predicted that by 2021 it will reach to 829 million.

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TECHNOLOGY OF THE COMING DAYS



Dr. Nikhilanand Panigrahy

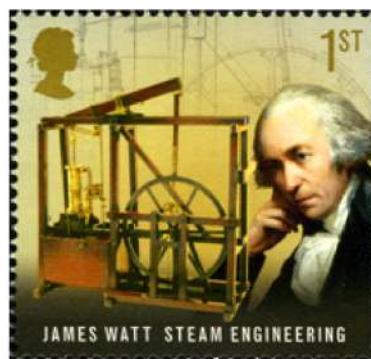
Normally we are curious to know the future. Such an urge might have driven a group of French scientists to undertake research for the past eleven years to know the future of human civilization basing on the trends and advances of current science and technology. The learned group has presented a picture that our future generation will be in a position to regulate the biological effect of age on human body. Further due to change in environment, our shape and size will be somewhat odd and different: our eyes and brain will be bigger. Almost all companies and employers will engage robots, replacing human beings. Blood cells and nano robots will coexist within our bodies. Such an arrangement will be the body structure of our future generations. Another acute problem will be the space crunch due to overpopulation. Hence man will be transported to other hospitable places in outer space. This is the picture, conjured up by the scientific team; but this situation is likely to occur after a thousand years. (Report published in December 2017).

Anyway, right now we are interested to know what will happen in the immediate future. For this, we may take the leads from the growth of science in the past few centuries. It may be based on the different stages of

Industrial Revolution that took place, in the following manner:

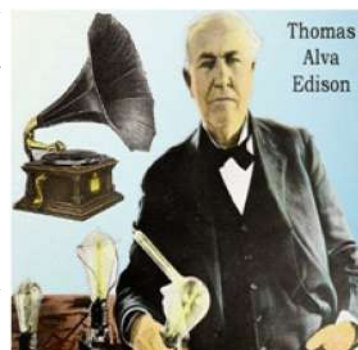
1. Caused by Steam Engine (not literally, of course)
2. Application and use of Electricity
3. Entry of computers, digital technology and internet

James Watt (Jan 19, 1736 - Aug 25, 1819), a Scottish inventor and instrument maker, is remembered for his substantial



contribution in the development of the steam engine, which converts heat energy (in the form of steam) into mechanical energy.

Electricity has drawn our attention from the long past. Its history is quite lengthy, but regarding its



application in our daily life, a very prominent name comes to our mind.... that of Thomas Alva Edison (Feb. 11, 1847 -Oct. 18, 1931), an American inventor who had a clear vision of its practical importance for the daily use of all people, including the lower strata of our society.

The later inventors also developed many electrical gadgets and appliances. Their common uses now-a-days in different countries can be stated in brief: entertainment, heating, lighting, refrigeration, air-conditioning, cooking, washing (which includes dry cleaning).

The third industrial revolution started presumably from 1960s onwards, which is now in vogue in different countries in different measures, depending on the degree of their respective development. But there is sufficient indication that the present state of affairs in the domain of computers, digital technology and internet will not remain the same, but take rapid strides by adopting improved and new techniques. Anyway, a significant contributor to this field is the English engineer and computer scientist Tim Berners-Lee (born at London, on 8 June 1955), currently working as professor of computer science at the University of Oxford. He is best known as the inventor of World Wide Web (WWW).



Tim Berners-Lee

Amitabh Kant, CEO, NITI Ayog, has summed up the emerging technological demands in the coming days as:

1. Autonomous robots
2. Simulation
3. Big data and analytics
4. Augmented reality
5. The cloud
6. Cyber security
7. Additive manufacturing
8. Horizontal and vertical integration
9. The internet of things
10. Artificial Intelligence.

All these above-mentioned branches have vital effects in their own way in shaping the modern industrialized society. (Of course these branches cannot be rigidly separated from one another). Out of the above, Artificial Intelligence is found to be a byword for all and sundry.

Artificial Intelligence (A.I.) has been introduced to the laymen in the following words by knowledgeable sources:

A.I. is defined as intelligence, exhibited by machines. It is applied in today's society in many ways through specified programming. It has been an effective means in medical diagnosis, electronic trading, robot control and remote sensing. Indeed, it has influenced the functioning with day-to-day innovations in the field of industries, including finance,

healthcare, education, transportation etc. Can India with its budding young and experienced researchers, scientists and technologists meet the challenge of the coming age in this highly competitive global atmosphere?

Steve Wozniak (popularly known as Woz) has engineered Apple 1, the first home computer with a key board and screen. He was a close friend and colleague of the legendary Steve Jobs. He visited India to participate in the ET Global Business Summit in New Delhi. In an interview (dated Feb 25, 2018), he remarked: "The culture in India is one of success based upon academic excellence, studying, learning, practicing and having a good job and a great life. For upper India, not the lower. I see two India. That is a lot like Singapore.... study, study, work hard and you get an MBA, you will have Mercedes. But where is the creativity? The creativity gets left out when your behavior is too predictable and structured, everyone is similar. Look at a small country like New Zealand, the writers, singers, athletes. It is a whole different world."

We in India complain that there is no job, whether we are highly educated or not. But unfortunately, we are not employable, in spite of our so-called certificates and degrees. We do not fit into the job requirements.

Further we have not developed an analytical mind for taking up any daring innovative entrepreneurship or ventures. Being misfits, it is not surprising that we will be jobless. It is true that the scope for traditional jobs has shrunk rapidly; but there is tremendous need for engagement of workers, if they are endowed with new skills.

Further we are lagging to explore cutting edge or pioneering works in Research & Development (R&D). This has downgraded our position in science and technology at international level. Our country is definitely independent, but our mind slavish. We do not develop original thoughts and ideas. This deficiency is a great hurdle for us to face successfully the challenges and demands of the ever-growing and changing science and technology in the coming days. We should be conscious about this deficiency. Unfortunately, we are out of phase with the trends at present. India needs urgently to wake up to face these new challenges posed by science and technology for the coming days.

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ROLE OF ATOM IN HUMAN LIFE

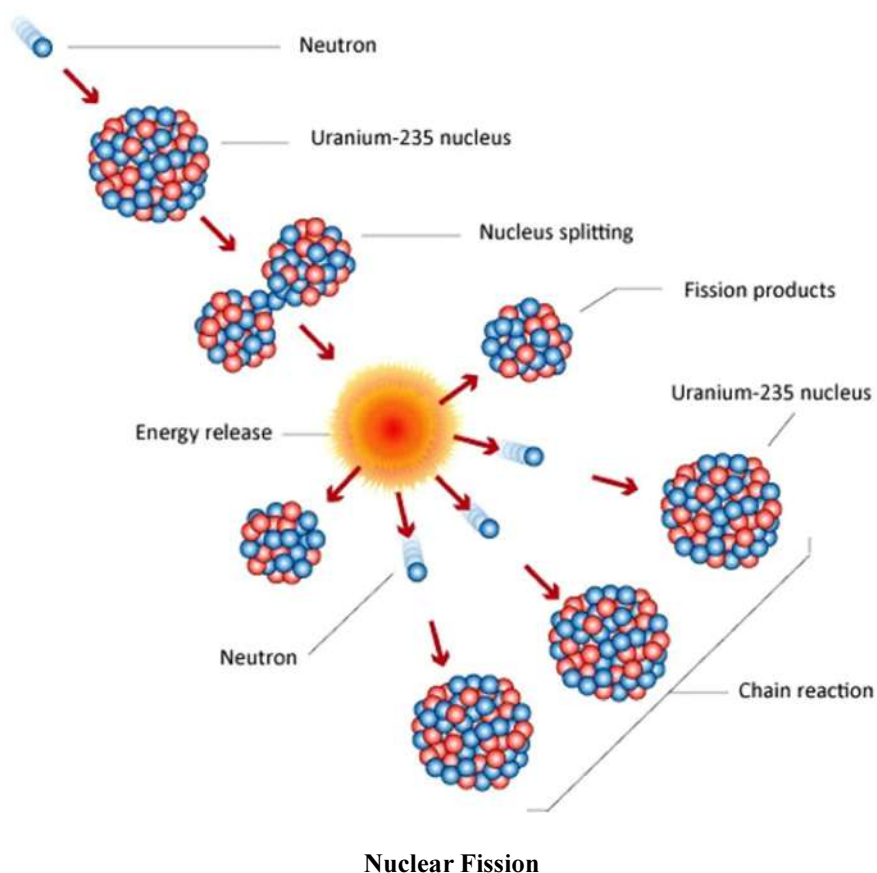
Ronie Adhiraaj Ghosh

It has hardly been slightly above a century when John Dalton proposed an atomic structure of matter which led to a revolution in scientific world of his time. Not much later than that time many great scientists carried out experiments which led to a complete model of atom that was considered to be the fundamental building block of every material elements in the universe. Becquerel, J. J. Thompson, Marie and Pierre Curie and many others discovered. Several phenomena in the atomic domain which set the background for the detailed study and experimentation for the structure of atoms. A milestone was achieved

when Ernest Rutherford was able to discover the very nucleus of the atom while investigating the structure of atoms by sending alpha particles as probes in a scattering experiment. Discovery of nuclear atom inspired Neils Bohr to propose an atomic model which was subsequently developed by Max Plank, de-Broglie, Schrodinger, Heisenberg, Dirac and many other proponents of Quantum theory. It was Albert Einstein who developed the special theory of relativity and as its outcome the famous $E=mc^2$ formula that stated the mass-energy equivalence through which one can be converted to the other.

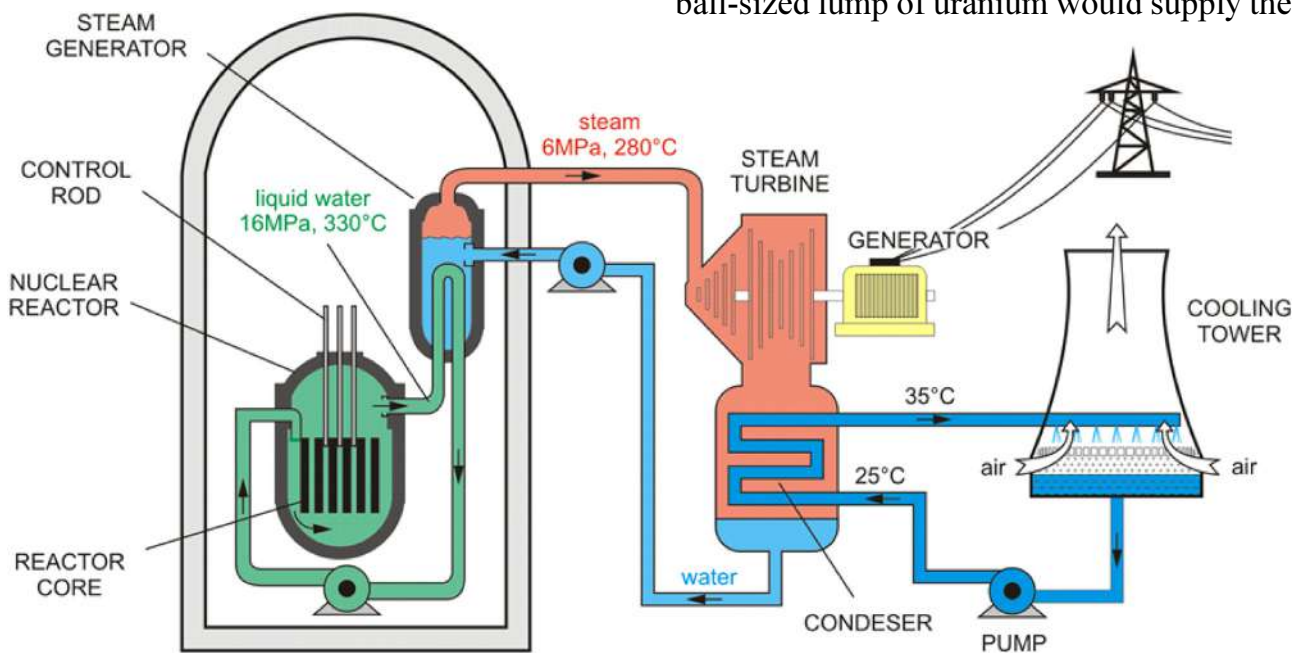
It was very unfortunate that all these experiments were carried out around World War I and World War II which led to the invention of Nuclear Bomb when nations of either sides of Allied and Axis powers were seeking ultimate weapon for winning the war. A huge shock came as nuclear bombing of Hiroshima and Nagasaki which caused so much devastation that till date civilised world refrains from using it again.

Wise thinking process of human beings led to establish a theory that Nuclear Energy can be used to generate electricity. It was as simple as setting up a Nuclear Reactor which heats up the water to generate steam and in turn



rotate turbine generators to produce electricity. On June 27, 1954 Obninsk Power Plant in USSR became the first electricity grid connected Nuclear Power Plant. Pretty soon it was realized that Nuclear Energy can reduce the dependency on fossil fuel in generation of electricity. This trend followed and very soon countries like USA, France, Germany etc. had their Nuclear Power Plants operational in major cities. India was not lagging behind as well. Under the guidance of Dr. Homi J. Bhabha, research in the field of Nuclear Science was introduced and in no time we had our first Nuclear Power plant commercially operational at Tarapur on October 28, 1969. In coming times Nuclear Power Plants were setup across India at Kota, Kalpakkam, Kaiga and Narora. Presently 22 Nuclear power reactors are successfully running in India with the capacity of 6780 Mega Watt of energy.

The very basic working of a Nuclear Reactor and associated power plant is simple to understand. The fissile Uranium atoms are split by striking the atomic nucleus with slow neutrons. The process is known as "Nuclear Fission". This process releases energy and produces more neutrons that in turn splits other uranium atoms. This process however is controlled and a sustained chain reaction is achieved. The energy produced as heat is used to boil water through successive water loops to produce steam and that steam is used to drive turbine generator for generating electrical energy. The electricity is then distributed via sub grids to different locations. The Nuclear Energy has been cleanest, safest and much more environment friendly than conventional fossil fuel energy sources like Thermal and Gas based power stations that release huge amount of toxic gases like Sulphur Dioxide into the atmosphere. A golf-ball-sized lump of uranium would supply the

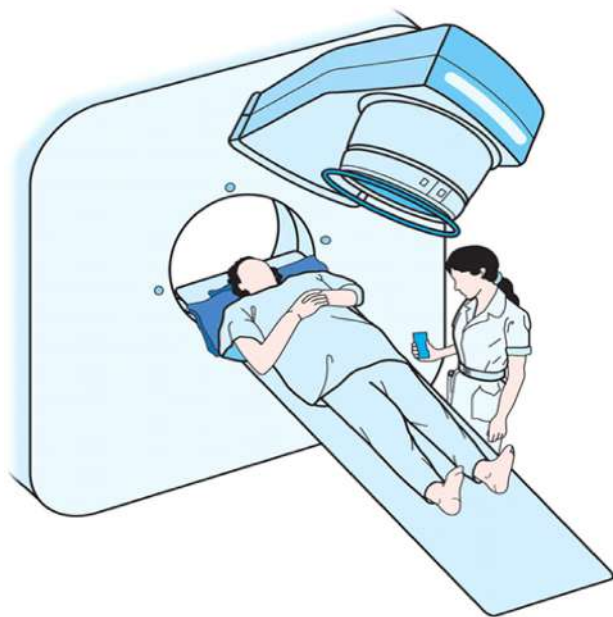


A Conventional Nuclear Reactor

lifetime's energy needs of a typical person which is equivalent to 56 tanker trucks of natural gas or 800 train containers of coal. Therefore to meet the growing energy need in the modern world it is highly essential to adopt Nuclear Energy as an excellent alternative source of energy.

Even after the nuclear fuel is consumed in a nuclear reactor, it still has tremendous potential to serve mankind by its byproducts. The heavier uranium atoms split into lighter atoms like Cobalt, Iodine, Molybdenum etc. These are Radioactive in nature and by harnessing these Radioactive sources mankind has developed new frontiers in Medicine, Industrial, Science and Agriculture sectors.

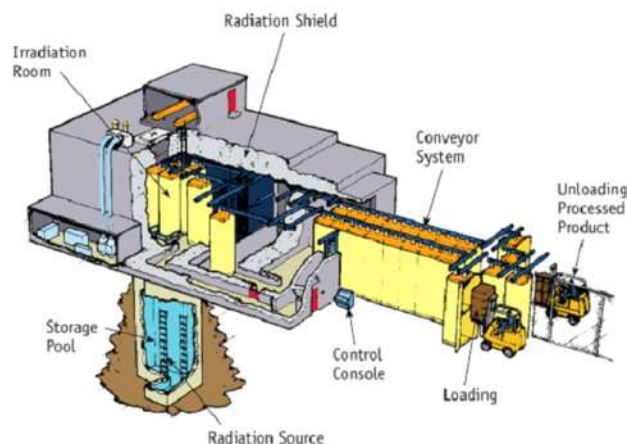
The byproducts such as Iodine and similar elements in its Radioactive isotope form is used for diagnosis and treatment of deadly diseases like Cancer. There are many isotopes of different elements that are used



A Radiotherapy Equipment for treatment of cancer

for treatment of various forms of cancer associated with different parts of body. It is also used for irradiation of blood before transfusion. So Nuclear energy and Radiation also saves lives.

In the field of Industry and Science there are processes such as Radiation hardening of Aerospace equipment and associated electronics before sending them into space, Non Destructive Testing of Industrial components by Gamma Scanning and Radiography makes sure that all Industrial components and structures are safe to operate. So we see that Nuclear Energy is itself safe to use and also increases safety in other fields in multi folds.



A Gamma Irradiation Plant

In Agricultural field the use of Radiation based sterilization process of food items and raw materials of agricultural and animal husbandry increases the shelf life of the products. It has been a boon for farmers for storage and proper long term utilization benefits of their products. The radiation processing of Animal products like leather and bones increases the durability of the products

made out of them by restricting microbial growth in them. The irradiation of associated medical tools and products used in surgery, packaging of medicines etc. sterilizes them completely and makes sure that no infections occur to the patients due to microbial growth in the same. Thus we see Nuclear radiation also adds to the food security, increases durability of products many folds as well as ensures us of complete safety of surgical and medical tools.

Nuclear Energy and Radiation has been a boon for mankind. It has changed the world since its discovery. Nuclear power is one of the least affecting sources of energy for the environment, and the green movement must accept its expansion if the world is to avoid dangerous climate change. Rising demand for energy will place ever greater burdens on the natural world, threatening its rich biodiversity, unless societies accept nuclear power as a key part of the energy. It is too risky to rely solely on renewable energy sources such as wind and solar power for replacing fossil fuels because of problems to do with scalability, cost, materials and land use. Nuclear power being by far the most compact and energy dense of sources, it could make a major and perhaps leading contribution. Thus Nuclear Power provides energy security. Moreover cost incurred in Operation and Maintenance of nuclear reactors are very less. Renewable sources like wind, solar and biomass will certainly play roles in a future energy economy. But those energy sources cannot scale up fast

enough to deliver cheap and reliable power at the scale the global economy requires. While it may be theoretically possible to stabilize the climate without nuclear power, in the real world there is no credible path to climate stabilization that does not include a substantial role for nuclear power.

Future developments in the world of Nuclear Science is the much awaited controlled Nuclear Fusion reaction that has immense energy delivering capability than conventional Nuclear Fission. Research activity across the world is being carried out for making the dream of cleanest source of energy come true.

In the Global effort in mitigation of Green House Gases the contribution of Nuclear Power is indispensable. New research in the field of efficient design of Nuclear Reactors and complete use of nuclear fuel has led to a multi staged nuclear program in India. The brain child of Dr. Homi J. Bhabha that is the 3 stage Indian nuclear programme is under development now and pretty soon we can hope that India will be self sustaining in the field of energy. The judicious use of Nuclear energy for peaceful purposes can be met globally by a global regulatory authority that identifies and creates centers for nuclear excellence and energy generating centers. By the use of nuclear energy we can make world a better place to live.



Scientific Officer-D,
Board of Radiation and Isotope Technology,
Department of Atomic Energy

TESLA COIL

Sri Siddharth Nayak

Technology is marching ahead day by day. And in this rapidly developing world when we go out to search the latest technology, a term comes to our notice i.e. wireless electricity. In a short period of time this technology has earned a great popularity. One such example is wireless charging in android phones. So How did the idea, "Electricity can be transferred without wires" came to the mind of the scientists? This was because of "Tesla Coil".

History:

Tesla coil was invented by Nikola Tesla in 1891. Out of 300 patents that were given by Nikola Tesla; Tesla coil was a truly revolutionary invention. Because this was the first system that could wirelessly transmit electricity. His invention of the tesla coil was the forefront of his vision for achieving worldwide wireless distribution of electricity. This invention completely revolutionized the way electricity was understood and used.

What is Tesla Coil ?

Tesla coil is an air core resonant transformer. It is used to produce high voltage, low current and high frequency alternating current electricity

Components of a Tesla Coil

(i) **Primary Coil:** It is a coil of an insulated wire. The wire is made up of a suitable conducting material such as copper or aluminium etc.

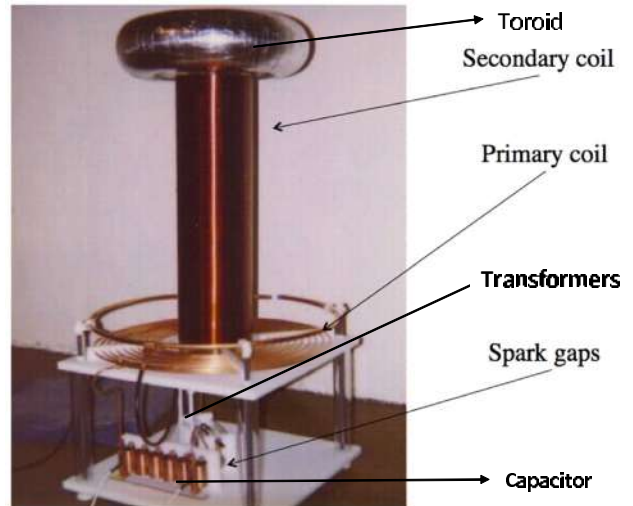
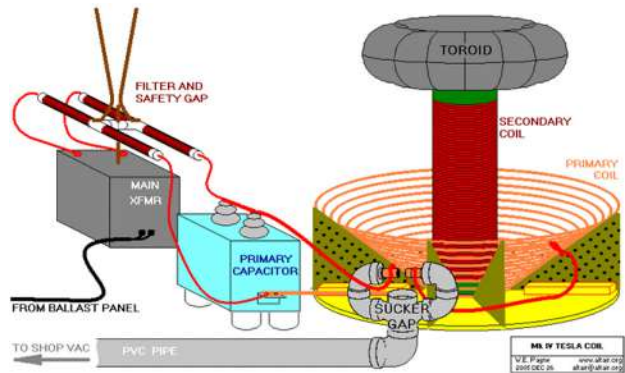
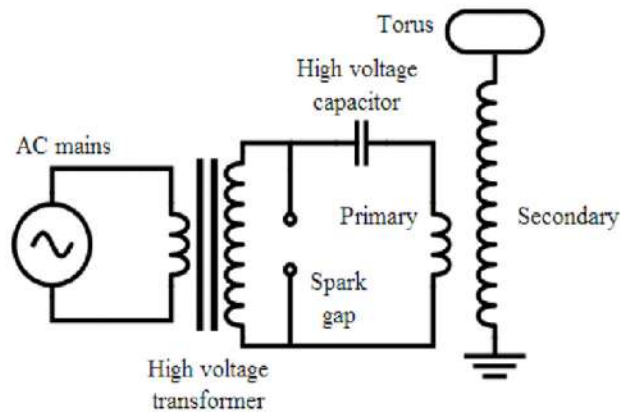


FIGURE OF A TESLA COIL



A FIGURE OF AN ADVANCED Mk IV TESLA COIL



CIRCUIT DIAGRAM OF A TESLA COIL

(ii) **Secondary Coil:** It has large number of turns of wire over a cylindrical shaped body. Therefore it uses thin wire used to make transformer or motor. These insulated copper wire are also called as magnet wire. (Not magnetic wire)

- (iii) **Spark Gap :** Spark gap is simply an air gap between the two metal plates, placed close to each other. Spark gaps are the brain of the Tesla coil. They are high voltage switches that allow the tank circuit capacitance to charge and discharge.
- (iv) **Toroid :** It has a large metal surface. Toroid acts as one plate of capacitor with the earth as other plate.
- (v) **Tank Capacitors :** These are the capacitors used in the circuit of a Tesla coil.
- (vi) **Transformer :**

Set Up :

The input of the transformer is connected to a regular outlet. The output of the transformer is connected to the tank capacitors. The tank capacitors are connected with one plate of the spark gap. Another plate of the spark gap is attached to the primary coil. The secondary coil is placed in between the primary coils. But the wires of the primary coil and secondary coil are not attached to each other. A toroid is placed over the secondary coil and it is attached to the wires of the secondary coil.

Working Principle :

It takes electricity from a regular outlet of 120 volts, which is passed through a high voltage transformer where the voltage is increased to 20,000 volts. As the stepped up voltage leaves the transformer the power

supply connection follows its path into the tank capacitors. So the stored energy in the capacitors increases voltage build up in it, until it reaches a level where the air insulation between the spark gap is broken and electrical energy is transferred. The air in the gap is an insulator until the voltage on the capacitor connected to the gap rises high enough to make a spark. Once the air is ionized by the spark, it becomes a conductive plasma which acts like a closed switch. This allows all the charge stored in the capacitor to discharge through the primary coil in a burst. When the capacitors charge is gone, the spark ends and the gap becomes an open switch again. Now the energy is transferred into the primary coil. The current discharged from the capacitor oscillates back and forth into the primary coil. The electric currents in primary coil radiates out the electromagnetic waves and they get inductively transferred into the secondary coil. The close proximity of the primary and secondary coil gives rise to a magnetic coupling and the two coils at the same resonant frequency generate an extremely high voltage in the secondary coil. As the voltage in the secondary coil increases to as much as 200,000 or more volts the toroid is unable to prevent its break out. The high electric field causes the air around the high voltage toroid terminal to ionize and conduct electricity allowing electricity to leak into the air in a colourful corona discharges.

Uses of Tesla Coil :

- (i) Tesla coils are used to produce high voltages for testing electrical instruments like switchgears, insulators etc.
- (ii) They are used for reproduction of music instead of loud speakers. A band called "Arc Attack" uses tesla coil for their performances.
- (iii) Tesla coil speakers are faithful in producing high frequency sounds. This is because of the fact that there is no vibrating diaphragm in them. Perhaps the Tesla coil speakers can replace these conventional tweeter speakers.
- (iv) Wireless induction charging is very similar to Tesla coils, but without the arcs.
- (v) Small Tesla coils are used in kirlian photography.
- (vi) Modified Tesla coils are used to generate plasma, Ozone and also as ion generators.
- (vii) Small coils are used in Electrotherapy which utilizes healing effect of certain frequency currents.

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LEANING TEMPLE OF HUMA

Sri Nikunja Bihari Sahu

Bordered by the dusty villages and open countryside, Huma village is located on the bank of the river Mahanadi, 23 km south of the city Sambalpur, Odisha. Here, Mahanadi is seen to be hurrying on a rocky bed with grace and grandeur. Huma is a famous Shiva temple of the district Sambalpur and the abode of Lord Vimalaeswara. Hundreds of devotees flock the shrine everyday for visiting the deity and fulfilling of their cherished wishes. However, the prime attraction of the place is a strange leaning temple that makes the shrine so unique. Nobody knows whether this structure is leaning by design or by default. One interesting fact is that while the edifice leans, the pinnacle of the temple is perpendicular to the ground. Amazingly, all other structures in the premises like the Bhairabi temple, Bhubaneswar temple, Aruna Stambha, Kapileswar temple and newly constructed Jagannath temple and Hanuman temples are also leaned. In fact, almost everything within the temple complex is slanting!

Legend

Lord Vimalaeswara is considered as the prime deity of a chain of 8 Shiva-Lingas (Astasambhu) of the region. The other Shiva Lingas are : Kedarnath of Ambhavana, Biswanath of Deogaon, Balunkeswar of Gaisama, Maneswar of Maneswar, Swapneswar of Sorna, Bisweswara of Soranda and Nilakantheswar of Nilji. The Shiva Linga (a cylindrical stone considered as the emblem of Lord Shiva) of Huma is believed to have a



Leaning Temple of Huma

natural origin cropped up from the underground. The legend has it that a cow from a nearby village was regularly visiting the place and secreting milk over the Linga. The owner of the cow, finding the cow's udder dry and milk-less, followed the cow secretly into the jungle and found to his great surprise that the cow's milk was pouring on a mysterious stone that consumed it quietly. He propagated this miraculous incident and everybody came to understand the glory of the Linga. This ushered in the worship of Lord Shiva.

Construction Period

The account of the founder and the founding period of the shrine are debatable and shrouded in mystery. According to the popular belief, the shrine is built by the 5th king of the Chauhan dynasty of Sambalpur named Baliar Singhdeo between the periods 1660 to 1690; that means, the shrine dates back to 17th century A.D. and is around 300 years old. There are some evidences to contradict the theory. According to an order issued by a British Settlement Officer A.M. Russel dated 5th November, 1872 the first king of the royal dynasty of Sambalpur Balaram Deo had dedicated 6 villages including Huma for the construction of the temple and carrying out of different religious practices and rituals of the deity. A court order

issued by a contemporary British judge also supports this view. Hence, it is natural to believe that the first king of Sambalpur, Balaram Deo or some of his immediate successors might have initiated the construction of the shrine instead of the 5th king of Sambalpur who probably completed the structure. Going by this fact, the period of construction will be considered little older than the accepted period of dating back from 1545 A.D. to 1560 A.D.

Despite the controversies as described above, the temple of Lord Vimala Swara of Huma stands elegantly leaning reminding us of the glorious past of the royal dynasty of Sambalpur.

Scientific Wonder

The shrine is built over a rectangular platform of 200 ft length and 120 ft width. The main temple of Lord Vimala Swara is clearly inclined towards the North-east side i.e. the river side. Due to the strange inclination, it is often compared with the Leaning Tower of Pisa of Italy which was constructed in the 12th century A.D. The surprising thing is that while the main temple is tilted to one direction, remaining small temples are tilted to other directions. Within the temple complex everything found to be in tilted condition including the boundaries. According to the popular belief, the angle of inclination has remained constant over last 50 years.

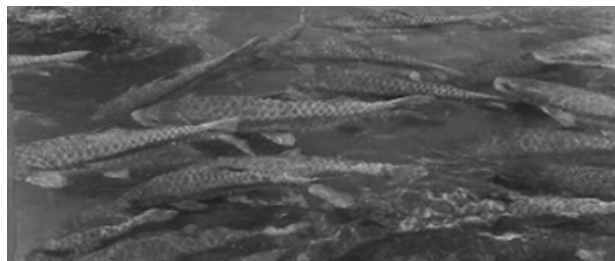
The reason for having a leaning structure of the shrine is again shrouded in mystery. Some scholars believe that the architect has deliberately made a leaning design from the beginning in order to safe-guard the temple from the violent currents of the two rivers i.e.

Mahanadi and Dhulijore during the flood in monsoon. This is why different structures are made leaning to different sides. This theory also explains why the degree of tilting remains unchanged all these years, and does not grow as in case of the other renowned tilting structures including the Leaning Tower of Pisa. Others hold the view that the temple gradually inclined over the years due to the depression of the foundation towards the riverside because of the impact of flood waters. Given these controversies surrounding the cause of inclination, one often wonders how the temple stands stable in spite of its inclination.

This is based on a simple principle in science called the 'Centre of Gravity'. The 'Centre of Gravity' of a body is an imaginary point where its entire mass is assumed to have been concentrated. The force of gravity acts through this point that creates its weight. Stability of bodies depends on the position of this point. As long as the vertical line passing through this point remains confined within the Base area of the body, the body stands stable. If this line goes beyond the Base area, the body becomes unstable. For this line to remain within the Base area, and hence, for the stability of the body following two conditions are to be satisfied:



Boat ride in river Mahanadi near Huma temple



Kudo fish in the river bank

- i) The 'Centre of Gravity' should lie as low as possible.
- ii) The Base area should be broader.

These two criteria for stability of bodies appear to have been taken into account in the design of the temple to achieve the inclination. Heavy stones brought from nearby quarries possibly in rafts in the river Mahanadi during the floods might have been stacked on the lower side of the temple for lowering of the centre of gravity. The temple is not quite high. The broad base area of the temple (200 ft x 120 ft) adds to its further stability. However, the exact degree of inclination of the temple is to be measured precisely from time to time and any change over time is to be carefully ascertained to ensure appropriate conservation measures.

Other Attractions

Apart from the leaning temple, a kind of reddish fish (popularly called Kudo) in the river is another attraction for tourists. One can also feed the fishes which have become very good pets over the years. Feeding these fishes is considered to be very sacred. Besides, one can also have a boat ride in the river Mahanadi to many small islands in it.

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DESIRABILITY OF CAESAREAN SECTION



Prof. Ramesh Chandra Parida

Pregnancy is just a normal process and since it is not a disease, external intervention should only occur for sound medical reasons. However, according to the International Health Care Community, globally about 23 million people opt for caesarean section delivery (2012 estimation) every year which is about 10 to 15% of the total delivery. In the US it is as high as 33% and in some of the African countries, as low as 7.5%. In our country it is spreading like an epidemic, thanks to busy obstetricians, who prefer it over the time consuming normal delivery and to those in medical business, who encourage it as it fattens the bill. As a result, the cases of caesarean section (or C-Section) reached 8.6% in 2007-2008, according to a survey conducted by the School of Public Health of the Indian Council of Medical Research, which has jumped by 8.7% between 2005-2006 and 2016-2017. Now it is 58% in Kerala and 41% in Tamil Nadu, the highest in the country. However, for the safety of the mothers and the babies the necessity is well within 15% as per the survey of the World Health Organization.

The history of surgery assisted delivery is not quite new. Some trace its roots to the ancient period of the Greek Civilization, but

the recorded history points it to 16th Century in Switzerland. However, it became more common in 19th Century after the introduction of antiseptics and anesthetics in medical treatments. Caesarean section or C-section in the present form came into being in the early parts of the 20th Century in Great Britain. Since then the procedure has gone a sea of changes and its application is expanding rapidly.

According to the recommendation of the World Health Organization, C-section should only be conducted under the conditions when vaginal delivery would put the baby and the mother at risk. Those include (i) Problems with placenta, umbilical cord or shape of the pelvis (ii) mothers with previous C-section (Each repeat is more complicated and the risk increases after the third surgery) (iii) twin pregnancy, particularly if the baby is in head of position (iv) the baby exists the pelvis with buttock or feet - first (breech presentation) as opposed to head - first presentation (v) emergency delivery when the mothers have developed hypertension or cardiac problem or some such life threatening complications (reserseitative hysterectomy or peri-mortem caesarean delivery) (vi) prolonged labour or failure of progress (dystocia), failed labour induction or failed instrumental delivery (by forceps or ventouse) (vii) problems like uterine rupture or an elevated risk thereof , amniotic rapture and large baby weight (more than 4000 gm.) or macrosomia and (viii) mothers with contaminant diseases like HIV or any other

sexually transmitted diseases or pre-existing conditions like previous uterine rupture, previous high risk fetus and bicomutate uterus.

It can also be done in rare cases of death of the mother if there is any hope that the baby may survive. On the other hand it can be undertaken on maternal request even if the doctor may think it to be unnecessary.

However, scant attention is given to these guidelines particularly in private hospitals. As a result in the recent time, the practice is growing exponentially, particularly among the urban people all over the world, including India. It is not only draining the purse of the patients, but also causing a number of health problems for the mothers as well as the babies. For example, in a pilot study some US-based scientists have found recently that babies born through C-section deliveries run the higher risk of obesity, asthma, celiac disease, type-1 diabetes, allergies and immune deficiency, because they are not exposed to their mothers' vaginal microbiome like those who are born normally. (Nature Medicine, February 2016). However, when such babies are swabbed with microbiome collected from the mothers' vaginal fluid soon after the delivery, the probability diminishes because it acts as probiotic.

C-Section birth are even said to be altering the course of human evolution. A group of researchers from the University of Vienna have found that the cases where the baby cannot fit down the birth canal have

increased from 3% in 1960s to 3-6% births today. According to Dr. Phillip Mitterocker, a member of the group, the head of human baby is larger in comparison with other primates which give birth relatively easily. Besides, as an evolutionary trend the size of the new-born are getting larger and larger. Therefore to make the process of delivery easier, the human pelvis should widen with time, but the opposite has been happening generation after generation, particularly with those who themselves were born with C- Sections. It is considered as a counter - evolutionary trend. If it continues the cases of C-deliveries may go on increasing bringing with it the associated problems. Therefore, in absence of medical needs it is certainly not desirable and must be avoided.

Alarmed by the state of affairs, our Woman and Child Development Minister Mrs. Maneka Gandhi has written to the Health Minister Mr. J. P. Nadda asking that it may be made mandatory for the private hospitals empanelled with the Central Government Health Schemes to display the data of C-Section and normal deliveries. She has further demanded that the Health Ministry should direct the State Governments to conduct periodic audits of the private hospitals to ensure that the unnecessary procedures are not conducted .

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VITAMIN B₁₂ RICH DIET - A PANACEA FOR FORGETFULNESS

Prof. Bhabendra Kumar Patnaik

Vitamins are organic compounds available in natural food and are essential for normal growth and nutrition of our body. They are classified on the basis of their solubility. While some vitamins are fat soluble (eg. Vit. A, D, E and K) others are water soluble (eg. Vit. B Complex and Vit. C). Vitamin B complex includes a variety of organic substances such as thiamin, riboflavin, pantothenic acid, niacin, pyridoxine, biotin, folic acid and cyanocobalamin which is otherwise known as Vitamin B₁₂. Researchers have found that among the members of Vitamin B Complex, Vitamin B₁₂ needs special consideration for its usefulness in various functions. It is a water soluble vitamin that plays a key role in normal functioning of the brain and central nervous system and production of RBC.

Sources of Vitamin B₁₂ :

Vitamin B₁₂ is neither synthesized in plants nor in animals except for a few species of bacteria. Humans obtain almost all their Vitamin B₁₂ from their diet. In vegetarian diet, milk and its products, fortified cereals, nutritional yeast and shitake mushrooms are the sources of Vitamin B₁₂. On the other hand eggs, meat, fish and shell fish provide Vitamin

B₁₂ in non-vegetarian diet. In all age groups the normal level of Vitamin B₁₂ should be in the range of 200 pg/ml to 900 pg/ml of blood. One picogram (pg) is one trillionth of a gram.

Chemical structure of Vitamin B₁₂

Formula of Vit. B₁₂ : C₆₃H₈₈CoN₁₄O₁₄P.

Vitamin B₁₂ is made up of two components. The larger component is corrin ring system containing four pyrrole rings. Cobalt is coordinated to four nitrogen atoms of pyrrole rings.

The second component is a ribonucleotide, 5, 6 dimethyl benzimidazole bound covalently by its 5' phosphate group to one of the side chains of corrin ring through aminoisopropanol (Fig. 1).

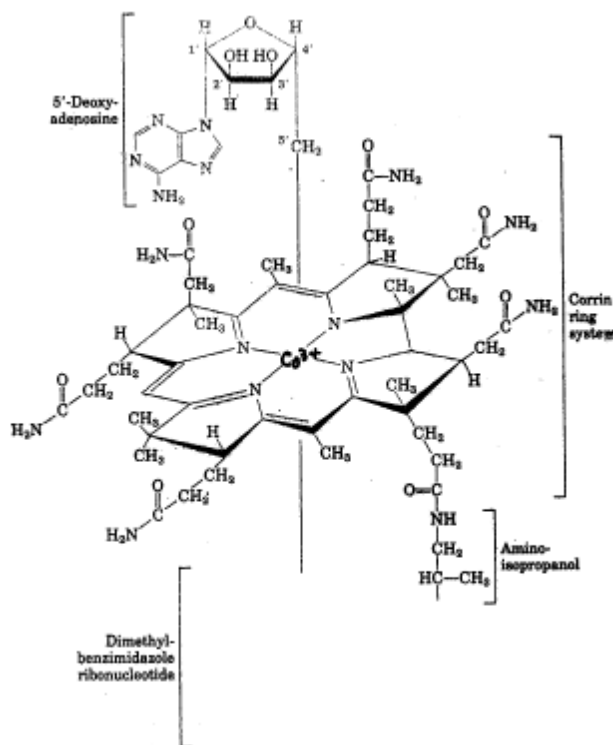


Fig. 1 : Chemical Structure of Vitamin B₁₂

Age groups more likely to be affected by Vitamin B₁₂ deficiency

Mostly pregnant women and elderly persons suffer from Vitamin B₁₂ deficiency. While in the former the requirement is more due to developing embryo, in the latter inadequate amounts in the diet are the reasons of the deficiency of the vitamin.

According to WHO, deficiency of Vitamin B₁₂ is emerging as a public health concern in many under developed countries since the susceptibility groups are infants, preschool children, pregnant and lactating mothers.

Symptoms of Vitamin B₁₂ deficiency :

Anemia, lethargy, fatigue joint pain, loss of memory and laxiness are the early symptoms of Vitamin B₁₂ deficiency.

Lack of the vitamin for a long period may lead to sensory and motor disturbances, ataxia (loss of power for muscular actions) leading to lack of voluntary coordination of muscle movements and cognitive decline leading to dementia (mental decay) and psychiatric disorders. Advanced stage of deficiency may lead to delirium (condition of mental confusion and excitement) and paranoia (mental disorder).

Low level of Vitamin B₁₂ in the blood may also spark off coronary artery disease.

In certain gastric ailments and in some autoimmune diseases (e.g. Crohns disease) there is a depletion of Vitamin B₁₂ in the body. Chronic alcoholism damages the lining of

stomach and intestine which hamper absorption of the vitamin. A glycoprotein required for absorption of Vitamin B₁₂ in the intestine, when not synthesized in adequate amount may also affect absorption.

In pernicious anaemia vitamin deficiency is persistent leading to reduced production of red blood cells (RBC) and decreased RBC count, low level of haemoglobin and severe progressive impairment of central nervous system.

Treatment of Vitamin B₁₂ deficiency related diseases

When blood analysis reveal a low level of this vitamin doctors usually advise the patients to take Vitamin B₁₂ injections for atleast five days followed by pills thereafter. In pernicious anaemia since Vitamin B₁₂ deficiency is persistent, long term injections of the vitamin is warranted.

To obviate Vitamin B₁₂ deficiency, we should take food containing adequate amount of the Vitamin regularly. People over the age of 14 should consume more than 2.4 micrograms (mcg) of Vitamin B₁₂ daily. In addition routine analysis of blood is also advised to keep ourselves aware of the deficiencies and act accordingly.

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ROLE OF NANOTECHNOLOGY IN NANO-MEDICINE AND NANO ROBOTIC SURGERY



Dr. Dwijesh Kumar Panda

Nanotechnology is the study of controlling and manipulation of matter on an atomic and/or molecular scale. It deals with structures with the size of 100 nanometers (one nano meter = 10^{-9} meter) or smaller.. Robot, a mechanical device that can be programmed to carry out instructions and perform complicated tasks usually done by human hand. Robotics has been in use for about 75 years, but only in past 5 years it has been recognized by the surgical community as an important tool.

Nanoparticles have large surface area compared to their volume. This allows a nanoparticle, to seek out and bind to certain tumor cells. Additionally, the small size of nanoparticles (10 to 100 nanometers), allows them to preferentially accumulate at tumor sites (because tumors lack an effective lymphatic drainage system). Limitations of conventional cancer chemotherapy include drug resistance, lack of selectivity, and lack of solubility. Nanoparticles have the potential to overcome these problems.

The small size of nanoparticles endows them with properties that can be very useful in oncology, particularly in imaging. Quantum dots with nanoparticle size have quantum

confinement properties such as size-tunable light emission. These are used in conjunction with MRI (magnetic resonance imaging). They can produce exceptional images of tumor sites. Quantum dots glow when exposed to ultraviolet light. When injected, they seep into cancer tumors. The surgeon can see the glowing tumor, and use it as a guide for more accurate tumor removal. These dots are much brighter than organic dyes and only need one light source for excitation. This means that the use of fluorescent quantum dots could produce a higher contrast image and at a lower cost than today's organic dyes used as contrast.

Surgeons are constantly looking for minimally invasive ways to treat their patients. The recovery is faster when a lesser trauma is inflicted upon a patient. Scarring is lessened and there are usually fewer complications in the aftermath of the operation. Through nanotechnology, tiny biosensors could be constructed. This can take these factors into account by shortening patient's recovery period and saving hospital expenditure, reducing infection rates within the hospital, reducing the waiting lists for operation and allowing doctors to treat more patients in the

same period of time. One of the greatest achievements of nanotechnology in surgery is "ideal graft". This is biocompatible and durable repairs of parts of the body like arteries, joints or even organs.

Silver is known for its anti-infective properties. It is effective against a wide range of bacteria and microorganisms. A nonporous silver powder will give a greater surface area and better anti-infective surface. Less silver is required to reduce the risk of any toxic side effects. Applications for nanosilver coatings on medical devices include implants, indwelling catheters, wound dressings, for burns and chronic wounds. The nanosilver enters the wound through body fluids which kill bacteria within 30 minutes. Each dressing can last for several days depending on the thickness of the layer of the nanosilver used.

Nano-technology provides goods and services that are obtained from matter at the nano-meter level. In the new technology, molecular systems are built atom by atom yielding a variety of new machines. The size of a virus is 50nm. Nano particles possess large surface area. Nano-medicine aims at ensuring the comprehensive monitoring, control, construction, repair, defense and improvement of all human biological systems, working from the molecular level using engineered devices and nano-structures to achieve medical benefit. Laws at nanoscale are different from

those of macro scale. These laws are quantum mechanical laws. As mentioned earlier nanoparticles possess large surface area with surface to volume ratio being extremely large. This gives direct improvement in a variety of material properties such as thermal and electrical conductivity, surface chemistry/catalytic rates and photonic behavior.

In the 1960s the ultimate limit of miniaturization was thought to be at the scale of macromolecules like the DNA, proteins which are made up of thousands of atoms and which are able to store information, transport, produce energy and communicate. Another class of macromolecules were enzymes which could accelerate chemical reaction millions of times. In 1970 the Nobel Prize winner Jacques Monod in his book *Chance and Necessity* pointed out that the minimum weight of enzyme is about 10-17 grams. This means that the living world could outperform the ultraminiaturized devices. At that time it was inconceivable that we might make machines smaller than macromolecules. The idea was that a single molecule is a material entity that sufficient spatial extension and temporal stability to embody a device in a machine. This idea took shape in 1990s. It was argued that one could start with a few atoms and combine them to make a machine with the right number of atoms. This idea is the basis of the new technique of Nano technology.

An instrument invented in 1981- the scanning tunneling microscope (STM) opened the door to this technology. Although the first picture of a single molecule was produced by the electron microscope in 1957, the STM made it possible not only to display the picture of a molecule on a screen, but also to touch the molecule with the tip of the microscope (STM). The tip of the STM can turn a molecule into the tiniest of machine. The first device made for physics experiment was a molecular wire. It is possible to combine molecular mechanisms to make molecular factories. One can build more complex systems. This goes by the name Monumentalization

Robotic surgery is the computer-assisted surgery developed to overcome the drawbacks of invasive surgical procedures and the limitations of open surgery. There are two methods to control the instruments. One is telemanipulator in which the surgeon remotely performs normal movements of surgery on the patient. In computer-controlled systems, the surgeon controls the robotic arms and its effects using a computer. The surgeon can remotely operate staying anywhere in the world. The autonomous instruments replace traditional steel tools. The new procedures reduce the tissue trauma associated with open surgery. The surgeon requires few minutes training. The learning phase is intensive and surgeons must operate on twelve to eighteen patients before they adapt the procedure. This

approach is used for prostatectomies, cardiac valve repair, and gynaecological surgeries. The robotic surgery is done with precision, miniaturization, smaller excisions, decreased blood loss, less pain, and quicker healing times.

Robotic surgery in the field of urology has become very popular. It has been extensively applied for excision of prostate cancer. During the past ten years, the urologists have become world leaders in the use of such technology. The robotic kidney transplantation is the biggest advance since its creation more than half a century. The robotic-assisted benign uterus removal (hysterectomy) has been shown to be more expensive than conventional laparoscopy hysterectomy. The role of robotic procedure in colorectal surgery appears to be safe. The optics of the 3-dimensional two camera stereo optic robotic systems are superior to the optical system used in laparoscopic procedures. The postoperative impotence or incontinence is improved by using the 3-dimensional optic system. In cardiac surgery, the robotic revascularization, coronary stenting and bypass to patients with disease in multiple vessels block have been performed successfully.

Nano-medicine aims at ensuring the comprehensive monitoring, control, construction, repair, defense and improvement of all human biological systems. This works from the

Applications in Medical Robotics

- Nano-robotics, although having many applications in other areas, have the most useful and variety of uses in medical fields.
- Potential applications include early **diagnosis and targeted drug delivery** for cancer, **biomedical instrumentation, surgery, pharmacokinetics, monitoring of diabetes, and health care.**
- Future medical nanotechnology expected to employ nanorobots injected into the patient to perform treatment on a cellular level.



molecular level using engineered devices. The nano-structures ultimately achieve medical benefit. Nano-particles entering into living organisms from technology materials may be harmful. These are not bio-degradable. Their effects on ecosystems can be dangerous and toxic to humans. The social implications are many. The privacy cannot be protected in an age of invisible microphones, camera and tracking devices. The nano-materials will cause hazards to the environment.

I acknowledge help from Prof. Trilochan Pradhan in writing this article.

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ENVIRONMENTAL POLLUTION AND REPRODUCTIVE HEALTH



Dr. Saileswar Nanda

Pollution in nutrition, in air, in water and in day to day life have caused immense health hazards in last sixty years - throughout the globe. More pronounced health hazards have been received in the developing countries. Scientific data shows this in last 70 years the chemical products of the world has increased 25 fold. The chemicals include pesticides, drugs, plaster, fertilizer and personal skin care products. Most of these chemicals in commercial use have little regulatory oversight for their introduction to the market, use, reuse or disposal, or their chemical effect on human beings. Most of these chemicals have their chronic toxicity on human body cells and specially on reproductive health. Experiments have proved teratogenicity of these chemicals in animal models. In human these chemicals can stop gametogenesis and or produce genetic deformities and derangements.

Looking at this adversely affecting chemicals, Europe has made a Regulatory system known as REACH, (Registration, Evaluation, Authorisation and restriction of chemical substances) as a progressive measure. The majority of chemicals known to have health impact have been tested before

being marketed. In other developing countries including India even though some pharmaceutical products are placed for clinical trials, still spurious drugs come to the market and cause many adverse health hazards.

Chemicals affecting preconception and parietal period

Toxic chemicals are currently distributed in homes, work places and communities. Moreover contaminated food, water and air and consumer products have many toxicants affecting reproductive health. These chemicals affect embryogenesis, cogenesis and spermatogenesis. Hence the developing embryo, neonate and even the childhood and adolescent population become vulnerable. Environmental toxicants affect cellular processes like meiosis, imprinting mitosis cell migration, maturation, proliferation and differentiation. The cellular blocking of the endocrine action and their signaling pathways and this gene expression and protein synthesis are affected, causing irrational cellular behavior. Even many a time the multiple chemicals affect the cell at different phases simultaneously.

EDCs-Endocrine Disrupting Chemicals

The chemical interfere with the synthesis, secretion, transport, binding action or elimination of natural hormones of the body, which are responsible for the maintenance of cellular homeostasis for reproduction, development and behavior.

The common EDC found in food, water, air or house dust or personal care products include - phthalates, bisphenol A (or BPA) Polybrominated diphenyl ethers (PBDES), perchlorate and some pesticides. Because hormone action is critical to human reproduction, chemicals that disturb the system can cause permanent damage. The most well known EDC is Dimethyl stilbestrol and its delayed effects are benign and malignant reproductive tract abnormalities and increased risk of Female Breast Cancer. Moreover Polycystic Ovarian Syndrome, Endometriosis, Uterine fibroid, Early Puberty and decreased sperm count and infertility are also the effect of the EDCs. These chemicals affect the steroidogenesis in ovary a Testis-causing infertility.

Even in U.S.A. a study shows at least 43 toxic exogenous chemicals in pregnant women, causing adverse health hazards and harm in reproduction and development. These chemicals include - lead, mercury, toluene, perchlorate, phthalates, pesticides, BPA, PFCs (perfluorochemicals), Poly Chlorinated

biphenyls and Polybrominated diphenyl ethers. Many other chemicals are found in consumer products and in the homes.

The whole world is worried about the Environmental Toxicants and Endocrine Disrupting Chemicals affecting human health and the Health of the Newborns. Scientists from all sectors of life, World Health Organization, United Natural Environmental Programme, Physician, Obstetrician, Pediatrics and Neonatologist are now together to face this challenge.

Proper Health Education to the public, to the pregnant women, to the social reformers and to all, to avoid the chemicals, the toxicants and the established pollutants is essential. Health Care System should take care of the pollution. Policy makers should be strong enough to avoid the dangerous chemical inflow, by making law and rules. Scientists, Physicians and Obstetricians should investigate and know the exact toxogen and chemical to avoid damage to the new born. The new generation should be healthy and genetically safe and sound. This is a global challenge to all of us. People, Scientists, Doctors and Social Reformers, all should join hands for a better future.

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SOIL LESS CULTIVATION; THE FUTURE FARMING

Dr. Siddhartha Swarup Jena

I. HYDROPONIC

What is Hydroponic growing?

Hydroponics is the practice of growing plants in sand, gravel or liquid with added nutrients either in a bath or flow of highly oxygenated, nutrient enriched water but without soil. In hydroponic gardening systems, plants are placed in a growing medium and nutrients are provided directly to the roots. In Latin, the word hydroponics means literally "water working."

History

In 1929, William Frederick Gericke of the University of California at Berkeley began publicly promoting that solution culture be used for agricultural crop production. He first termed it aquaculture but later on introduced the term hydroponics or water culture, in 1937.

One of the earliest successes of hydroponics occurred on Wake Island, a rocky atoll in the Pacific Ocean that was used as a refueling stop for Pan American Airlines.



Hydroponics was used there in the 1930s to grow vegetables for the Air line passengers. Hydroponics was a necessity on Wake Island because there was no soil, and it was prohibitively expensive to airlift the fresh vegetables.

Introduction

Hydroponics (from the Greek words hydro means water and ponos means labour+ics) is a method of growing plants using mineral nutrient solutions, without soil. Terrestrial plants may be grown with their roots in the mineral nutrient solution or in an inert medium, such as perlite, gravel, or mineral wool.

For the plants growing in soil or the terrestrial plants the process of biological decomposition breaks down the complex organic matters into their basic nutrients that feed on plants. Water dissolves these nutrient salts and allow their uptake by the plant roots. For a plant to get balanced nutrition everything must be available in the soil and that too in perfect balanced state. Rarely, one can find such ideal conditions in the soil due to inadequate amount of organic matter left on the soil surface, soil contamination and biological imbalances. Plants that are grown in soil have to continuously develop their root balls in search of water, nutrients and air. So the majority of the plants available energy is spent on the lower root development restricting their shoot growth.

In hydroponics, the water, nutrient and air is provided directly to the root ball, thus allowing the plant to use its available energy for the growth and development of the upper parts such as leaf, flower and fruits.

To support the plants in a hydroponic system, an inert soil-free medium like fibre, sand or stone, may be used to anchor the roots. These hydroponic mediums are designed to be very porous for excellent retention of air and water that is necessary for the healthy plant-roots to breathe.

Nutrient solutions

The nutrient solution used for hydroponic systems contains mainly inorganic ions of soluble salts of essential elements necessary for higher plants. The proper formulation of hydroponic solutions is necessary to prevent nutrient deficiency which is commonly found in traditional soil based agriculture. As in conventional agriculture in hydroponics also nutrients should be adjusted to satisfy Liebig's law of the minimum for each specific plant variety. Currently 17 elements are considered essential for most of the plants, and that includes : carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, copper, zinc, manganese, molybdenum, boron, chlorine and nickel. Hoagland solution and modified Hoagland solutions are commonly used nutrient solution for soil-less cultures.

Nevertheless a generally acceptable concentration of different essential elements exists for the preparation of nutrient solutions. However, the minimum and maximum concentration ranges for most plants being somewhat similar. Most nutrient solutions are mixed to have concentrations between 1,000 and 2,500 ppm.

Advantages of hydroponics:

- The roots of the plant have constant access to oxygen and access to as much or as little water as they need. This is one of the important reasons of over- and under- watering. Hydroponics prevents this by providing the required amount of air, water and nutrients to the plants and any unused water gets drained away, recirculated, or actively aerated, eliminating anoxic conditions of the root systems.
- In soil based agriculture a grower needs to be very experienced and should know exactly the time period and the quantity of water requirement of the plant. Because too much of water will make the plants unable to access oxygen; and too little of water will render the roots to lose their ability to transport nutrients.
- But the plants grown in a hydroponic system are provided with an exact and specific doses of nutrients, so the crop raised hydroponically develop to their optimum levels of appearance, yield and flavour.

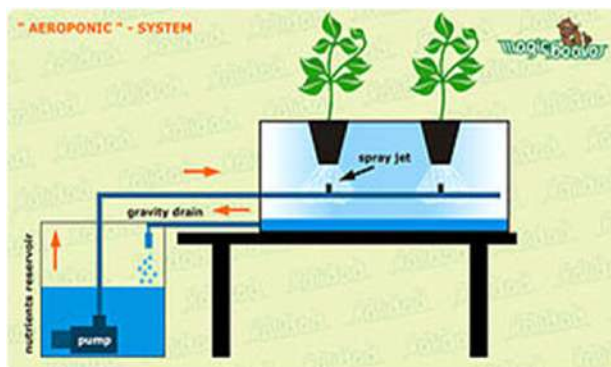
- In hydroponic system, the plants do not produce elaborate root systems.
- When the plants are grown in a soil less medium their roots do not need to grow constantly in search of nutrients. Therefore more plants can be grown in a smaller area.
- It is also environment friendly and does not cause any pollution.
- Additionally, water loss due to evaporation is very less in hydroponic systems so it can also work effectively in drought stricken areas.
- Soil based plants are usually susceptible to pests, weeds, and soil borne diseases. But with hydroponic gardens these problems do not arise.

Limitation of hydroponics:

- 1 kilogram (2.2 lb) of water can only hold 8 milligrams (0.12 gr) of air, irrespective of use or not use of the aerators.
- Certain species of plants can only survive for a particular period in water before they become waterlogged.

II. AEROPONICS

Aeroponics is a system wherein roots are continuously or discontinuously kept in an environment saturated with fine drops (a mist or aerosol) of nutrient solution. The method



requires no substrate and entails growing plants with their roots suspended in a deep air or growth chamber with the roots periodically wetted with a fine mist of atomized nutrients. Excellent aeration is the main advantage of aeroponics.

Aeroponic techniques have proven to be commercially successful for propagation, seed germination, seed potato production, tomato production, leaf crops, and micro-greens. Since inventor Richard Stoner commercialized aeroponic technology in 1983, aeroponics has been implemented as an alternative to water intensive hydroponic systems worldwide.

Advantage of aeroponics over hydroponics:

- Any species of plants can be grown in a true aeroponic system because the micro environment of an aeroponic can be finely controlled.
- Suspended aeroponic plants receive 100% of the available oxygen and carbon dioxide to the roots zone, stems, and leaves, thus accelerating biomass growth and reducing rooting times.

- Aeroponically grown plants have an 80% increase in dry weight biomass (essential minerals) compared to hydroponically grown plants.
- Aeroponics used 65% less water than hydroponics.
- Aeroponically grown plants require ¼ th of the nutrient input compared to hydroponics.
- Unlike hydroponically grown plants, aeroponically grown plants will not suffer transplant shock when transplanted to soil, and offers growers the ability to reduce the spread of disease and pathogens.

Aeroponic techniques have been given special attention from NASA since a mist is easier to handle than a liquid in a zero-gravity environment.

III. FOGPONICS

Fogponics is a derivation of aeroponics wherein the nutrient solution is aerosolized by a diaphragm vibrating at ultrasonic frequencies. Solution droplets produced by this method tend to be 5-10 µm in diameter, smaller than those produced by forcing a nutrient solution through pressurized nozzles, as in aeroponics. The smaller size of the droplets allows them to diffuse through the air more easily, and deliver nutrients to the roots without limiting their access to oxygen.

Conclusion

In short, soil-less farming allows to increase the yield approximately two to ten times in half the space and half the time required for normal farming. So, one can start hydroponic cultivation in a greenhouse, conservatory, spare room, loft, cellar, or closet. The farming practices have been changing with time by pioneering and perfecting commercial solutions and to grow crops sustainably, scalably with zero pesticide or harmful chemicals. In recent decades, NASA has done extensive hydroponic research for its Controlled Ecological Life Support System (CELSS). Hydroponics intended to take place on Mars are using LED lighting to grow in a different color spectrum with much less heat. Ray Wheeler, a plant physiologist at Kennedy Space Center's Space Life Science Lab, believes that hydroponics will create advances within space travel, as a bio-regenerative life support system.

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GI TAG AND ITS SIGNIFICANCE

Dr. Guru Prasad Mohanta

There has been a controversy over the origin of famous sweet 'Rosogulla' between West Bengal and Odisha. This finally settles with Geographical Indication (GI) tagging of 'Banglar Rosogulla' in favour of West Bengal. This GI tagging is not for 'Rosogulla' but for 'Banglar Rosogulla'. Odisha has the option for GI tagging of its own Rosogulla: *Odishara Rosogulla* or *Pahala Rosogulla*. This article does not intend to go into the controversy on the origin of Rosogulla but gives the basics of the GI tag and why one should be interested on it. GI tagging identifies the unique characteristics of a product based on its geographic origin. It provides a special status to the product and often the assurance of quality. In a country like ours where we are joined by borders and divided by cultures, the issue of GI tagging makes much significance.

The Geographic Indication is a special protection right for a product that has specific geographical origin and possesses qualities or reputation that are due to the origin. In order to get the GI tag, it is essential that a sign must identify a product to the place of origin and the qualities, characteristics or reputation of the product are essentially due to the place of origin. The agricultural, natural or manufactured goods originating in a particular area can be registered for GI tag. Some well -

known GI tag products are: Basmati Rice, Darjeeling Tea, Kanjeevaram Silk Sarees, Nagpur Oranges, Kolhapuri Chappal etc. Currently, there are around 270 Indian products who have GI tags. Any association of persons, producers, organization or authority established by or under the law can apply for GI registration of products.

The concept of GI is not new but the formal protection of GI as a form of intellectual property rights (IPR) came into existence following the famous General Agreement on Tariffs and Trade (GATT) in April 1994. Following this agreement, there have been series changes in National Laws in all World Trade Organization (WTO) member countries. WTO, established in 1995, is the custodian of global intellectual property rights in all its member countries including India. As a part of India's international obligation, Government of India enacted Geographical Indications of Goods (Registration and Protection) Act 1999. It was not just the international obligation, India too felt the potential of some of its products who can derive the benefits from GI tag and thus the new law. This law came into effect from 15th September 2003. The Controller General of Patents, Designs and Trade Marks, is the authority for administration who is also the Registrar of Geographical Indications. The Geographical Indications Registry is located at Chennai.

Registered GI Tagged Products of Odisha

Sl. No.	Product	Type
1.	Kotpad Handloom Fabrics	Handicraft
2.	Orissa Ikat	Handicraft
3.	Pipli Applique	Handicraft
4.	Konark Stone Carving	Handicraft
5.	Orissa Pattachitra	Textile
6.	Khandua Saree and Fabrics	Handicraft
7.	Gopalpur Tussar Fabrics	Handicraft
8.	Dhalapattar Parada and Fabrics Saree	Handicraft
9.	Sambalpuri Bandha and Fabrics	Handicraft
10.	Bomkai Saree and Fabrics	Handicraft
11.	Habaspuri Saree & Fabrics	Handicraft
12.	Berhampur Phoda Kumbha Saree and Joda	Textiles
13.	Ganjam Kewda Root	Agriculture
14.	Ganjam Kewada Flower	Agriculture
15.	Orissa Pattachitra (Logo)	Handicraft
16.	Bell Metal Ware of Datia and Tikamgarh (Logo)	Handicraft

Geographical Indication rights are territorial in nature. This means that the rights are limited to the country where GI is registered. There is nothing like global or international GI rights. However, there are ways to protect the GI tag in other countries. A registered GI is valid for 10 years and can be renewed from time to time on payment of renewal fees. The Act provides punishment for falsifying GI: imprisonment ranges from six months to three years and fine ranging from fifty thousand rupees to two lakh rupees.

All products are not permissible for GI registration. The following categories of products are not permissible for registration:

- Product's use is likely to deceive or cause confusion or be contrary to any law;

- Product comprises or contains scandalous or obscene matter or any matter likely to hurt religious susceptibilities of any class or section of the citizens of India;
- Product is in generic name;
- Product has ceased to be protected in their country of origin or which have fallen into disuse in that country;
- Product is falsely represented by persons claiming that goods originate in another territory, region or locality as the case may be.

Consumers, worldwide, have been paying more or more attention to the geographical origin of the product and often prepared to buy at a premium. GI tag functions as a product differentiator on the market which helps the consumer to distinguish between products with geographical origin based characteristics and others without these characteristics. This has a big business sense. The GI tagged products have several advantages like: competitive advantages, more added value to the product, increased export potential, and a strengthened brand.

A geographical indication's reputation is a valuable asset. If it is not protected through registration, it could be used without restrictions leading to its diminished value. GI registration prevents the registration as trade mark by third party. The products of Geographical Indications are the property of the region and should be protected from being exploited by others.

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THE FLIP SIDE OF DEVELOPMENT



Prof S. K. Mohapatra

Science is not only a process to explore and understand the nature but also an institution to solve problems of the society and provide the basic needs through sustainable development that preserves the environment for future generation. It is true that our basic needs - food security through improved agricultural practices, health security through new techniques of more accurate diagnosing of diseases, painless surgery, preventive inoculation and new medicines and vaccines to combat viral diseases have been addressed to some extent. Quality of life has been improved with better communications facilities.

Innovative technologies are based on scientific research and in turn technologies have helped scientists to discover. Though we have made rapid strides in the field of research and technology, the question arises : "Have we made our earth more hospitable?" Have we really made our lives more comfortable? The developments have been made at a great cost of our natural resources along with inherent menaces of far reaching consequences. Some of the menaces associated with great discoveries to worry about are presented here.

1. **Nuclear Menace** - Increasing demand of energy for domestic uses, setting up of industries, development of infrastructure with

the objective of providing jobs has depleted the natural resources, such as, fossil fuels. This has forced scientists all over the world to look for alternate sources of energy.

In course of their search for detection and identification of trans-uranium elements suggested by Mc Millan, O. Hahn and F.S.Strassman led the foundation of a new source of energy- "the atomic energy". They observed that, when uranium-235, thorium-233 and plutonium 239 atoms are hit by slow neutrons they split into two fragment pairs of unequal mass along with release of 2 to 3 neutrons and large amounts of energy. This energy could be harnessed to generate electrical energy, if carried out in a controlled manner in a suitable reactor but if uncontrolled would lead to explosion that can be unimaginable destruction of life and property. The latter finding gave rise to unhealthy competition between nations for making nuclear weapons for defence purpose as well as destroying enemy nations (Hiroshima and Nagasaki are witness to the ugly side of the discovery).

Besides weapons, safety of nuclear reactors and waste products generated by them are radioactive. (Chernobyl and Fukushima disasters are witness to the unsafe character- not only irreparable loss of life and property took place but also thousands of survivors became crippled). Disposal of the nuclear wastes poses greater concern as either they are to be dumped in the sea bed in lead containers or buried deep under earth to get rid of the dangerous radiations they emit. The

former would wipe out the marine life and the latter would be disastrous in case of an earthquake nearby.

2. **Plastic Menace** - Discovery of synthetic plastic (phenol- formaldehyde) by Dr Leo Bakeland in 1905 marks the beginning of plastic age. The twentieth century witnessed the large scale production of various polymer products for domestic use (water pipes, insulation of electrical appliances, from buckets to smart phones, carry bags to containers for food grains) as well as for producing laboratory equipment as it is light and convenient to mould to any desired shape.

Unfortunately, most of these articles are not bio-degradable and contribute 10% of the total solid waste being generated every year that has polluted not only the land but also the rivers and oceans. (Waste generated per day in our country was around 16,000 tons in 2013 and has gone up to 40,000 tons per day). Incineration of the wastes emits dangerous toxic gases such as dioxin, furan, halogens and carcinogenic brominated compounds. Efforts to make bio-degradable polymers, based on carbohydrates or proteins have not been viable in industrial scale to tide over the menace. Attempts to use plastic waste in road making and producing liquid fuels have been suggested as a solution.

3. **E-Waste Menace** - Radio, T.V. Smart phones, computers, laptops have become indispensable for entertainment to gathering information both sense and nonsense. United Nations workshop on environmental research

has revealed that we are producing 41 million tons of electronic waste every year and it is likely to increase to 50 million tons per year by 2020. The life time of computers, mobiles T.V., freeze, and printers are shorter with new versions coming to the market. These wastes are being exported to underdeveloped countries by unscrupulous traders where they are being dumped or being burnt producing dangerous radiations and polluting the atmosphere that has serious impact on the health of the people.

Cyber crimes are on the increase. Hacking of computers for secret information of individuals for blackmailing and defence related information of other countries are common now. Social media is being used to spread rumour and create chaos in the society. Hackers are planning dangerous schemes to damage information through new virus.

4. **Space Menace**- Desire to unravel the mysteries of the universe, look for existence of life beyond earth through journey into space, to explore natural resources on land and ocean, inaccessible areas, for prediction of weather, for communication with countries (sharing of information) through satellites have become a passion for all countries to prove upmanship in the field of technology.

As a consequence, thousands of satellites and other debris are orbiting the earth either having completed their mission or having run out of fuel increasing thereby the risk of crashing down on the earth after collision with each other. Study says that 3-4

satellites are lost every year in this process and about 170 million pieces of junk are already in space.

NASA and Space Agencies around the world carefully plan out the re-entry of these large bodies to give a watery grave. The ocean is the best place near south pacific roughly 3000 miles off the coast of Newzealand, 2000 miles north of Antarctica and 2.5 miles deep under water, far from human civilisation, is the best place. The other alternative thought of is the used up satellites are to be blasted off far away in space, known as grave yard orbit. The famous 142 ton Russian space satellite " MIR" was decommissioned in 2001 and was sent for orbital decay in the grave yard. International space stations of Japan will eventually crash into Pacific Ocean upon it's decommissioning around 2008. The question arises as to how many satellites need to be launched and at what cost.

5. Robotics and artificial Intelligence- Robots are being developed by scientists to carry out construction, repair works in inaccessible areas including difficult surgery. They have been successful to some extent in imparting artificial intelligence to them to provide solutions to vexed problems. Robot Sophia surprised the science world by giving correct answers in an International conference on science and technology at Riyadh. But such a device would always work on principle and respect for the human aspect, is questionable. It may even become more intelligent than its creator. MIT Brigham young University scientists have developed

artificial intelligence system that can negotiate a compromise and maintain relationship more effectively than human. Are we creating "Frankenstein's"? If the Robot can carry out all works then what will we do?. Will human wealth become redundant?.

Scientist Ellen Musk and Stephen Hawkings, who are working on artificial intelligence have expressed apprehension that the Robots may go out of control one day to end up in destroying the human race. If man can use science, use nuclear head missiles to serve his selfish objective, why the Robots cannot do it. Researchers at Tokyo University have developed an advanced Robot named "kengoro" that has muscles that would enable it to run, play games and excrete artificial sweat. NASA and defence advanced research projects body have teamed up to build up robotic technology that can refuel and repair friendly satellites, work as service stations in orbit and drastically improve their longevity.

Conclusion

Spiritual values taking a back seat, the changed life style, desire to acquire more and more to fulfil our unlimited wants and ease of getting work done, over dependence on mechanical systems will ultimately make our youth restless, physically disabled and a sick society. Science without conscience, humanity would turn our earth to a garbage pond. Let us introspect before it is too late to save the earth from perilously close to the inevitable end.

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ROLE OF PLANT KINGDOM IN REGULATING ENVIRONMENTAL POLLUTION



Prof. Basant Kumar Mohapatra

Pollution affects plants and animals alike, but there are some plants that can indicate the level of pollution and also have the ability to tackle the pollution to some extent.

Plants, that are able to assess the extent of pollution are known as phytoindicators and the process is called bioindication. Phytoindicators can serve as an index of the state of environment of a particular region. Under exposure to high concentration of pollutants, in the surrounding environment, plants suffer from acute injury with externally visible symptoms like "Chlorosis" (yellowing or whitening of green plants because of decreased amount of chlorophyll), necrosis (death of cells on tissues) and deformities of plants organs and ultimate death of plant. Pollution may also cause certain physiological changes in plants such as low photosynthesis, decreased growth rate and crop yield, changes in cell sap pH. Stimulation of respiration and irregularity of enzyme action. All these detectable features help environmentalists to identify the presence of a particular pollutant in nature.

A phytoindicator can not only be used as a chemical sensor of pollution, but also a measure of pollutant levels on the basis of their survival or mortality and pollutant intake. Efficiency of a phytoindicator species varies

with geographical and climatic condition. Plants of large species range are better indicators than plants of small species range. Numerical relationships between species population and whole communities often provide more reliable indications than single bioindicator species. Disturbance in metabolism or insufficient nutritional uptake may produce some physiological symptoms in plants than often resemble pollution damage. Influence of pollutants on plants depends on the species, stage of development and the organ or tissue involved. So morphological alteration and floristic composition of plant community, both are given equal weightage to indicate change in environment.

Air Purifiers

From time immemorial we have the knowledge about some plants serving as air purifiers. That is the reason why certain trees like Peepal, Pakur, Bel, Bargad (Banyan Tree), Makhan Katari, Neem, Kadam and Arjuna have been worshiped by people long since. Certain other plant species like Scavengers can help in cleaning the environment by retention of toxic pollutants in their bodies. These type of plants are called pollution mitigators and the process is known as

phytoremediation. During taking up of nutrients, roots of these plants absorb various metallic and non-metallic wastes from polluted soil. Pollutants thus accumulated in roots and shoots either break up into elemental form and excreted or are converted into some volatile compounds that get released into air. Inside plant body the pollutants can develop abnormality in some plants. To avoid this some potent plants also develop certain chemicals in their body which form sulphur containing polypeptides to protect the plant body from these toxic pollutants. The polypeptides form organometallic compounds by combining the toxic metals with sulphur containing aminoacids like cysteine or methionine. However, excess accumulation of pollutants result in death of the plant.

Heavy metals and oil products released from industrial and mining operations and fuel combustions pose a threat to the environment including soil quality. There is a significant relation between heavy metal pollution in soil and crop damage. For example, copper is absorbed by crops and accumulate in roots which decreases the growth rate and crop damage. Trace amounts of heavy metals present in edible portion of crop pose danger to human beings and live stocks. Soil pollution bio indicators are essential to establish bioindicators. One "moss" species is the bioindicator for Pb, Cd etc. Similarly, some bryophyte species is the bio indicator for Mn, Zn, Cd, Cu, Co, Ni, Cr and Pb. Bio indicators are less expensive than chemical monitoring indicators.

Bryophytes can indicate the presence of elements and their concentration gradients. Mosses and Lichens are the most effective biomonitors of low and moderate deposition of pollutants. Higher plants act as biomonitors in the assessment of heavy metal concentration due to their bioaccumulative properties. Plants also demonstrate morphological and physiological responses to heavy metal pollution, some of which may be utilized in bioindication. Metal aerosols pollute soil and plants. Higher plants not only intercept pollutants from atmospheric deposition but also accumulate aerosol metals from the soil.

High ascorbic acid content in the plant cells helps the plants resist the toxic effect of the pollutants. Certain metal ions generated through effluent uptake in the plant cells produce free radicals which can damage the plant. Flavonoid compounds present in plant cells act as antioxidants which help as scavenger of these free radicals. The well known plant pigment, β -carotene and certain phenolic compounds present in plant tissues also maintain the toxicity level of pollutants within a permitted limit.

Control of Indoor Pollution

Indoor pollution has come to be a major health hazard now-a-days. Problem is enhanced due to overcrowded, congested and unhygienic living conditions. Cooking and heating by solid fuels produce pollution. In urban areas, artificial fibers, cleaners,

cosmetics, hair sprays, insecticides, polishes, polywood boards, dry cleaned cloths etc. cause harmful fumigating effects by releasing benzene, formaldehyde and trichloroethylene etc. in the households. Formaldehyde is present in foams, carpeting materials, insulating boards, resins and adhesives cause pollution. Certain potted plants placed inside the rooms as decorative items help in reducing the pollution levels along with an increase in moisture content with addition of oxygen to indoor air also. Certain other plants like Amaran thus gracizns, Argemon Mexicana and a number of such type of plants function as bio-accumulators. All these plants are usually weeds growing in fields or aquatic habitats where they are not wanted. Such plants may be grown in pots inside the rooms. These plants for their metabolism use sulphur and nitrogen from sulphur dioxide and nitrogen dioxide present as pollutants. These plants also have a well developed oxygen radical scavenging system.

Therefore, it should be understood and emphasised that plants possess the power to improve the quality of the environment and thereby human health. Certain plants that have the ability to act as sinks for pollutants can be harnessed for the good of mankind.

Reference : Science Reporter.

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STRATEGY TO MAKE PRE-SCHOOL PERIOD LIVELY

Dr. Pritishri Parhi

The child for the first time is brought away from home when he enters the nursery school. This weaning from home and mother no doubt creates a great deal of anxiety in the child . Some children are very reluctant to come to school, some used to cry, some pretend to be ill and some really fall sick. So it is up to the nursery school to avoid these types of situation and to make pre-school a pleasant place for the child so that the child will be eager to go to the school. The nursery school is actually a supplement to home and not a substitute. In cooperation with the home, the nursery school gradually introduces the child to a longer group and side by side acquaints him how to stay away from their parents for at least a couple of hours.

We all know childhood is the formative period in the life of the individual . The brain/ minds of all the preschoolers are like the blank paper. So, whatever things we teach them is going to be persisted throughout their life. Childhood is known as the play age. They do learn but in a play way method. Parents and teachers should try to promote the environment with play way method which will stimulate their child and make their childhood memorable. The nursery education aims at the all-around development of the child-i.e.

physical, motor, cognitive, moral, emotional, social and aesthetic development. It helps the child to develop good health habit, proper attitudes and desirable social skills. It leads better adjustment to groups and makes the child disciplined. In the school curriculum activities like jumping, running hopping skipping, balancing etc should be provided for physical and motor development of the children, side by side other activities like colouring, drawing, scribbling, garlanding, beading, threading etc for finer muscle development, counting, puzzle work, putting toys inside and outside, clay modeling etc for cognitive development, storytelling recitation, telling of own experience for language, social and moral, development cleanliness, sanitation, appreciation of beauty developing giving first hand information like how germination takes place, how sugar and salt both are dissolved in water but sands are not dissolved, how iron is attracted by magnet etc should be explained to them in pre-school. Most important is concept clarification. The concept like number, letter, fruits, vegetables, colour, season, days, opposites, animals, baby animals, their place of living body parts, plants, different place etc must be cleared to them.

In the pre-school, children are spending a very short time period. But this time is totally valuable. So teacher should plan it in such a way that the around development of the child can be possible. There must be balance

between group play and individual (play, active play and free. play, guided activity and quiet activity, outdoor game and indoor game, pre-reading and pre-writing skill, recitation and storytelling.

All the activities of the school must take into account the developmental level and needs of the children. A child is ready for certain activities at a particular age. If these activities are introduced to the child at the right age, no doubt children will develop interest to learn them.

I have seen, many parents insist their children to write A, B and so on. But it is not the actual procedure. If we practise the age old practices like Brahma, Bishnu, Maheshwara to the children (the pre-writing skill) they can learn all the alphabets easily. For example writing of left half-circle, right half-circle, circle, straight line, right and left straight.

Now-a-days all the parents are interested to provide a rich environment to their children. A lot of books, toys, dresses, chocolates, play materials and what not. The thing which is very important for our children but are not provided them is our time, our association, with them. When both the parents are working they can afford certain costly things to their children, but throughout the day they leave their children in the hands of ayahs, servants or in crèche. If grandparents are there it is to some extent relaxed. Children can get love

and affection. Otherwise piles of toys, books are there but parents are not there to involve with their children. Parents should be with their children to show the path. They should play with the children and with their toys, they should make them learn. If they involved themselves in this way they can achieve their goal i.e. the all round development of their children. Their children must know that their parents are there to help them assist them, and give them courage which make them self-confident from the beginning.

So parents should spend as much time as they can with their children. Play with them guide them and provide different and different type of experience. Sometimes take them, to their friend's house, sometime to park, zoo, museum, market place, village place, to their grandparents and relatives. Celebrate most of the festivals in a traditional way by which they can know about our tradition and customs. Tell them stories from Mahabharat, Ramayan and people of great importance like Mahatma Gandhiji, Nehruje, Sardar Ballavbhai Patelji, Recite Lori when they are going to sleep, so that in their dream also you can make them happy.

Now, the parents are becoming aware of the home-school relationship. They know nursery school should be an extension of home and to achieve this they have to maintain a close relationship with the school. For the better development of their children, they

have to get information about their children from the school and help the teacher to plan activities for their children. The parents can meet the teacher at the time of leaving and taking the children in the school. During these encounters many relevant bits of information are gathered and ideas are exchanged. Parents-teacher meeting is another source where parents can check the copies, drawing and other materials of their children. Teacher can talk about their children's performance, difficulties, problems etc. Sometimes some celebrations like parents day, grandparents day annual function, athletic meet some project work, talk on health and hygiene may be conducted collaboratedly which can bring both the teacher and parents close to each other. By this way the ultimate result of providing an enriching environment which will stimulate the optimum development of the child is possible.

Children are the future of our nation. If their foundation of education will be made strong, definitely they will sparkle on their future as valuable citizens of our country. So the pre-school and activities of pre-school must be of great importance.

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PALYNOLOGY AND ITS APPLICATION

Rajballav Mohanty¹
Taranisen Panda²

Palynology is a scientific discipline concerned with the study of plant pollen, spores and certain microscopic planktonic organisms in both living and fossil form. Mainly it deals with the plant pollen or microspores, the male reproductive unit, meant for sexual reproduction in spermatophytic plants, reported for the first time by Grew in 1676. It is produced inside the microsporangia or pollen sac of the anther, which is a part of the stamen or microsporophyll of the flower.

Pollens are produced in large number practically in plants with anemophilous pollination. They are minute in size, usually 10-100 microns and like particles of dust. The shape varies from round to oval, disc shaped, bean shaped and sometimes filamentous. They are mostly white, cream, yellow or orange colored and smooth to spiky in texture. Structurally it is initially unicellular and double walled. The outer wall "Exine" is tough and composed of a class of material called "Sporopollenin", i.e. highly resistant to physical and biological decompositions, for which pollen grain walls are often preserved for long periods in fossil deposits. This resistant pollen wall also fulfils the important protective function during its hazardous journey from anther of one flower to the stigma of another flower. Moreover this outer

wall is ornamented with various stratifications of different patterns, proved to be of much taxonomic value. They usually permit the assignment of an individual grain to the family, often to genus and rarely even to species. The inner layer "Intine" is thin delicate pecto-cellulosic in nature and there are some definite thin and weak slits or pores called "germ pores" present in "Exine". The pollen tube, as a rule, emerges at the germ pores on the pollen grains at the time of germination. After the successful transfer of pollen grains to the female part of the flower i.e. stigma, the pollen grains are activated. There is division and re-division, formation of two antherozoid or spermatozoid carried by the pollen tube near the oosphere or egg, present deep inside the megasporangia or ovule, ultimately leading to successful fertilization and formation of embryo and endosperm respectively in angiospermic flowers.

Scope of Pollen Study

Although the basic function of pollen is to carry out sexual reproduction in spermatophytic plants, due to its unique characters like very minute and light body, distinctive ornamentation and high resistance to decomposition, it leads to the development of a branch in science named palynology. Since the first use of this term by Hyde and Williams in 1845, several important contributions have been made in this field and it has now emerged as an important interdisciplinary subject with many fundamental and applied aspects of study and research.

The scope of Palynological research is now extremely broad, ranging from pollen morphology application in Geology, Archaeology, Forensic science, Allergic study, Limnological study etc. The Palynological research can be either basic or applied.

A. The basic aspect

i) **Palynotaxonomy** - The pollen morphological features is used as a criteria to plant taxonomical study. The sculpturing patterns of pollen exine are so characteristic that, often they can be used in plant identification much in the same way as fingerprints are used in identification of an individual. Taxonomists employ pollen morphological attributes in systematic works i.e. in solving controversial taxonomical and phylogenetical problems, identification and determining the affinity etc.

B. Applied aspects

- i. **Palaeopalynology** : It is the study of fossil pollen grains which helps in
 - a. Identifying an unknown sporomorph up to the level of respective family, genera and species
 - b. Tracing the presence of fossil fuels, coals and oils
 - c. Ascertaining the availability of past vegetation
 - d. Determining the past climate and ecology

- e. Geologists use palynological data in biostratigraphy i.e. to correlate strata and determine the relative age of specific bed called Geochronology
- f. Copropalynological study can be carried out i.e. the study of palynomorphs present in coprolite, which is the fossilized excrement.
 - ii. **Aeropalynology**: It is the study of palynomorphs which include pollens, spore and other bio particles in the atmosphere. Pollen grains from the air can enter into the human body and cause allergy reactions including sneezing, clogged and itching nose, throat and eye and may cause Hay fever.
 - iii. **Forensic palynology**: It is the study of pollen morphology where in the pollen grains are used as evidence in investigation of criminal cases and to resolve other legal problems. It also includes identifying and linking the suspects to the scene of the crime. The pollen grains obtained from the deceased body can be traced and identified to a specific plant type, from a specific site or region and helpful in solving the crime.
 - iv. **Entomopalynology**: It is the study of pollen grains that are associated with insects and helpful in research on honey bees, foraging distance of insects and pollination biology etc.

- v. **Mellitto palynology:** It is a study of pollen present in honey which can provide many informations including a) the plant species foraged by the honeybees, b) the identified plants can provide the fingerprints of environment and pollen spectrum from where the honeybee comes, c) it is an indispensable tool to authenticate whether the honey is unifloral or multifloral, d) helpful in detecting allergic pollens in honey and also helps in identifying pollens that are toxic to bees and can cause bee poisoning.
- vi. **Medico palynology:** Some spores and pollens are applied to human health problems traditionally. For instance, spores of *Adiantum* are used to cure cough, pollen grains of *Cycas* has narcotic properties while *Lycopodium* spores was used for the treatment of stomach disorder.
- vii. **Archeo palynology:** It is the study related to the human uses of plants in the historical past times, which helps to determine the site of occupation, agricultural practices and plant related activities of the area with archaeological context. Ex. Bonfire shelters.
- viii. **Limnological study:** It is the study of water bodies of the past and to determine the lake levels as well as the climatic changes of the ancient times.
- ix. **Organic palynofacies study:** It helps in collecting and providing information on various depositional sediments of an area.
- x. **Edibility:** Pollen grains are rich in nutrients. In western countries, varieties of pollen tablets and syrups are available in the market, which are claimed to enhance the performance of athletes and race horses.

The basic criteria used in pollen recognition are their shape and size, number of germination pores and their position and the cell wall configuration. In India, the main centers of palynological research are the National Botanical Research Institute at Lucknow, Birbal Sahni Institute of Palaeobotany at Lucknow, Osmania University at Hyderabad and Bose institute, Calcutta.

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QUIZ ON BIOSCIENCES

Dr. B. K. Mohanty

Note: Choose the most appropriate choice for selecting your answer to the question.

- The term 'resolving power' refers to :
 - Magnification
 - Smallest distance between two objects
 - Size of the image seen with microscope
 - None of the above
- Sodium Dodecyl Sulphate (SDS)
 - Binds to hydrophobic region of protein
 - Disrupts nearly all non-covalent interactions in the protein
 - Separates protein molecules
 - Polymerizes gel
- A mutation in P⁵³ gene may lead to
 - DNA damage
 - Uncontrolled cell division
 - Arrest of cell division cycle
 - Cell death
- Which statement about t-RNA is correct?
 - All t-RNA molecules contains a large number of unusual modified bases.
 - All t-RNA molecules have CCA at 3' end
 - Only a is correct
 - Both a and b are correct
- The symbiotic bacteria occurring in root nodules of leguminous plants is:
 - Rhizobium*
 - Azotobactor*
 - Bacillus*
 - Nitrosomonas*
- Hydroponic is:
 - Growing aquatic plants
 - Growing of floating aquatic plants
 - Soilless cultivation of plants
 - Growing plants inside water
- In cellular respiration, which of the following processes occur only in Mitochondria and not in cytoplasm;
 - Glycolysis and TCA Cycle
 - Citric Acid Cycle and Oxidative Phosphorylation
 - Glycolysis and Pentose Phosphate Pathway
 - Only TCA Cycle
- CRISPR-Cas 9 system is a:
 - RNA guided DNA Endonuclease System
 - DNA damage repair enzyme
 - Reverse Transcriptase
- 2-Aminopurine induces mutation by
 - Base pair change
 - Frameshift
 - Duplication
 - Insertation
- The essential element required for synthesis of Auxin is:

a. Zinc	b. Sulphur
c. Potassium	d. Phosphorus
- Bacteriod means:
 - Dead bacteria
 - Living bacteria of both gram - positive and gram - negative types.
 - A bacteria like substance
 - The non-spore forming gram-negative bacilli that form part of human resident flora.
- Which of the following green house gases has got highest atmospheric life time?

a. CO ₂	b. CH ₃
c. N ₂ O	d. CFCs

13. Ion can be accumulated against concentration gradient due to:
 - a. Mass Flow
 - b. Active uptake
 - c. Passive uptake
 - d. Donnan Equilibrium
14. Collagens are :
 - a. proteins abundantly present in animals
 - b. Triple helical Structure
 - c. Extremely rich in proline and glycine
 - d. having all of the above Characters
15. The semi-autonomous organelles found in cell are:
 - a. Ribosome
 - b. Chloroplast
 - c. Mitochondria
 - d. Both b and c
16. Lipid rafts are found in:
 - a. Cell Wall
 - b. Plasma membrane
 - c. B Cell
 - d. Insulin
17. The left handed DNA is :
 - a. B-DNA
 - b. RL-DNA
 - c. Z-DNA
 - d. R-DNA
18. SEM (Scanning Electron Microscopy) is used to study :
 - a. Stained Specimens
 - b. Multi colored images
 - c. Living microorganisms
 - d. Surface structure of microorganisms
19. Gram -ve and Gram + ve bacteria differ in their:
 - a. Chemical composition
 - b. Thickness in cell wall
 - c. Cell structure is different
 - d. All of the above Characters
20. Which one of the following is a microbial disease of the nervous system :
 - a. Poliomyelitis
 - b. Tetanus
 - c. Leprosy
 - d. All the above
21. Botulism is caused by:
 - a. *Bacillus cerus*
 - b. *Staphylococcus aureus*
 - c. *Clostridium botulinum*
 - d. *Salmonella* sps
22. The molecular marker system used in the genomics is/are:
 - a. RFLP
 - b. SSR
 - c. SNP
 - d. All the above
23. The five major types of antibodies or Ig are:
 - a. IgA , IgB , IgC , IgD and IgE
 - b. IgA , IgF, IgG, IgH and IgM
 - c. IgA , IgD, IgE, IgG and IgM
 - d. IgA , IgC, IgE, IgF and IgH
24. In bioremediation approach for environmental cleanup ,the options are:
 - a. Bio agumentation
 - b. Bio stimulation
 - c. Phyto remeditation
 - d. All of the above
25. The source of energy used for inoculated cells/tissues in tissue culture media is:
 - a. Agar
 - b. Sucrose
 - c. Inorganic Nutrients
 - d. Growth hormones
26. The energy rich molecules produced in TCA cycle are:
 - a. 2GTP, 2(NADH+H⁺) and 1FADH₂
 - b. 1GTP, 2(NADH+H⁺) and 1FADH₂
 - c. 1GTP, 3(NADH+H⁺) AND 1FADH₂
 - d. 2GTP AND 3 (NADH+H⁺)
27. Which of the below mentioned protein is not apoptotic?
 - a. BCL-2
 - b. BCL-XL
 - c. A1
 - d. BAX

28. Which one of the followings is one of the most powerful buffer system of blood ?
 a. Bicarbonate b. Protein
 c. Phosphate d. Hemoglobin
29. An example of pandemic type of outbreak of disease is
 a. Malaria b. AIDS
 c. Polio d. Hepatitis
30. The structural organization of bacterial DNA is:
 a. Circular and double stranded
 b. Circular and single stranded
 c. Circular only
 d. Linear and double stranded
31. The principles of centrifugation is based on:
 a. mass of the biomolecules
 b. density of the biomolecules
 c. RCF (Relative Centrifugal Force)
 d. Gravitational force
32. The sequence in PCR (Polymerase Chain Reaction) are:
 a. Annealing → Denaturation → Extension
 b. Denaturation → Synthesis of DNA → Extension
 c. Denaturation → Annealing → Extension
 d. Denaturation → Extension → Annealing
33. Transcriptomics is the study of
 a. proteins with in a cell
 b. m-RNA with in a cell
 c. gene interactions in a cell
 d. DNA database of a cell
34. The Charges on the amino acids depends on
 a. side chains of the amino acid
 b. C-terminas of the amino acid
 c. N-terminus of the amino acid
 d. pH of the medium
35. Which lipid does not contain any fatty acid ?
 a. Phospholipid b. Steroid
 c. Glycoglyceride d. Suberin
36. The example of non-genetic RNA found in cell for specific function is
 a. r-RNA b. Sn RNA
 c. hn RNA d. both b and c
37. If the $[H^+]$ in mol/L of a solution is 10^{-4} , then the pH and $[OH^-]$ in mol/L will be:
 a. 10 and 10^{-4} b. 4 and 10^{-4}
 c. 4 and 10^{-10} d. 14 and 1.0
38. The peroxisomes are associated with
 a. detoxification of cell metabolism
 b. Photo-respiration in plants
 c. Lipid metabolism in animals
 d. all of the above functions
39. The DNA sequencing method was developed by:
 a. EM Southern
 b. Sanger and Barrel
 c. Maxam and Gilbert
 d. Both a and b
40. The most important instrumental analysis used for pollution studies in the present day is:
 a. AAS b. GC-MS
 c. MS d. HPLC

ANSWER

- 1 (b) 2 (b) 3 (b) 4 (d) 5 (a)
 6 (c) 7 (b) 8 (a) 9 (a) 10 (c)
 11 (d) 12 (d) 13 (b) 14 (d) 15 (d)
 16 (b) 17 (c) 18 (d) 19 (d) 20 (d)
 21 (c) 22 (d) 23 (c) 24 (d) 25 (b)
 26 (c) 27 (a) 28 (d) 29 (b) 30 (a)
 31 (c) 32 (b) 33 (b) 34 (d) 35 (b)
 36 (b) 37 (c) 38 (d) 39 (d) 40 (b)

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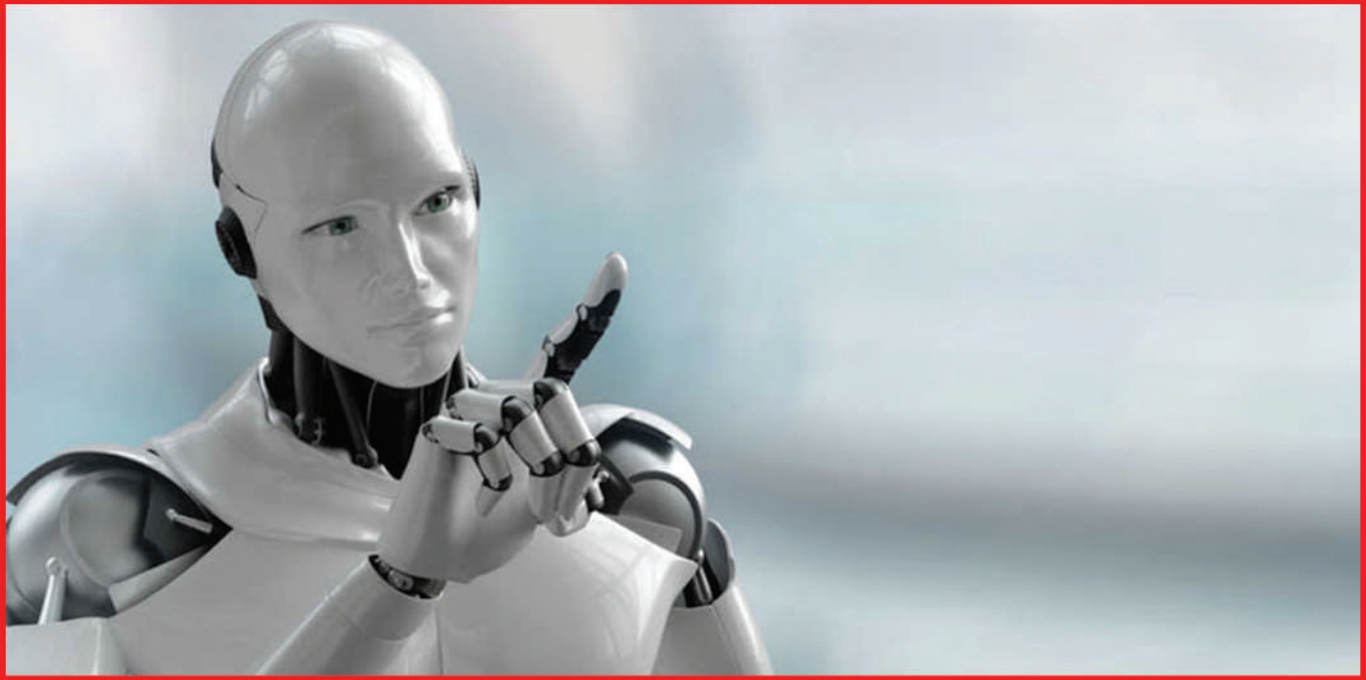
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