Science Horizon

ODISHA BIGYAN ACADEMY

5TH YEAR | 10TH ISSUE | OCTOBER 2015

ARTICLE REQUESTED FOR SPECIAL ISSUE OF 'SCIENCE HORIZON'

A special issue of 'Science Horizon' (December 2015) on **'LIGHT AND LIFE'** in view of the International Year of Light 2015 (light with all its aspects, history of human awareness about light, its role and significance in life, various sources of light, natural and artificial indoor lighting, light in science technology art and culture) will be published. Writers are requested to contribute Articles/Poems/Essays/Fictions/Quiz/Science Cartoons on the above themes. Articles with attractive titles, subtitles and original diagram/photo (or photocopy) as desirable, which should be in easy and simple language to be easily understood by common reader. Student writers can send their articles through their respective heads of the institution. References should be mentioned at the end of the Article.

The article should ordinarily be of two to three printed pages in one side of A-4 size paper with attractive headings. Authors are requested to send their articles by **31.10.2015** and give their E-mail, Contact details, passport size photographs etc. The articles should be sent to the Secretary, Odisha Bigyan Academy by the following address by post/in person alongwith softcopy (MS Word) through E-mail **(odishabigyanacademy1@gmail.com).**

The article should be original and not to be copied or translated from any other source. In the forwarding letter along with the article, the author is required to give an undertaking/ statement that the article is original and not reproduced from any other sources.

Secretary, Odisha Bigyan Academy

Errata, September 2015 issue

Page 2, Editorial :the world "1012" to be read as **"10^{11} (hundred billion)"**

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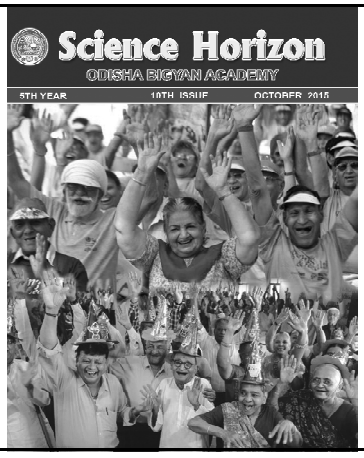

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The Cover Page depicts : **On the occasion of World Elderly Day.** ***Cover Design : Sanatan Rout***

EDITORIAL

CHALLENGES AND OPPORTUNITIES FOR AN AGE FRIENDLY WORLD

The UN report on World Population ageing published in 2013, has indicated that the ageing of the world population is progressive and rapid. It is an unprecedented phenomenon that is affecting nearly all countries of the world. The population of old or elderly people (60 years and above) is growing at a faster rate than the total population in all regions of the world. In 1950, there were 205 million old persons aged 60 or above in the world. By 2013, the number of old persons had increased to almost 841 million and it is projected to reach more than double by 2050, reaching 2 billion. Thus the process of change towards an elderly society is inevitable and it is seen throughout the globe. Presently, about two thirds of the world's elderly people live in developing countries and the number of older persons is increasing most rapidly in urban areas of developing countries. Thus the number of people over 60 living in cities may grow up to one-fourth of the total urban population in developing countries, where social protection systems are weak and developmental work is still in progress.

The life expectancy at birth has increased substantially across the world. Presently the human life expectancy is 78 in developed countries and 68 years in developing regions. Increasing human longevity is one of the greatest achievements of humanity. People now live longer, because of improved nutrition, sanitation, advances in health care, education and economic well being. It is one of the demographic shifts with implications on all aspects of our society. Population ageing has far reaching impact on the health and overall quality of life in societies across the world. But the social and economic implications of this phenomenon are profound extending far beyond the individual older persons and the immediate family, touching broader society and the global community in unprecedented ways. Population ageing is a challenge for both government and societies. Elderly people require income security, flexible employment opportunities, access to affordable health care, age friendly housing and transportation and a supportive environment, especially by the elimination of discrimination, abuse and violence targeted at them. Above all they want to remain active and respected members of society. But such challenges need not be seen as a crisis. This demographic shift can create endless opportunities for the society through the contributions of a socially and economically healthy, active and secure ageing population. On the positive side, it opens up new markets and brings up more experienced workforce, a growing cadre of custodian of our cultural ethics and unperturbed illumined minds who can show light to the society at the time of difficulty.

Thus to ensure an age friendly world and having "Sustainability and Age Inclusiveness in the Urban Environment" (the theme for World Elderly Day 2015) in which everyone, including older persons, is given the chance to contribute to development and share its benefits. Here all persons are properly treated and included in decision making that affects them. In spite of significant progress in implementation of various policies, programmes and legislation focusing on older persons in many countries of the world, age discrimination, limited access to health care, poverty and lack of income security and lower esteem still persist in old age.

To meet the challenges of building an age friendly community, policy makers and planners are encouraged to take proactive approach and to engage with multiple stakeholders including older people to create conditions for active ageing. Policies and legislation must be enforced so that older persons can enjoy their human rights and programmes must be implemented and monitored to ensure that they reach those most in need. Thus by maximizing the opportunities of a growing older population, the society will reap the benefits of the "longevity dividend".

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NOBEL PRIZE IN PHYSIOLOGY OR MEDICINE 2015

Prof. Niraj K. Tripathy


Youyou Tu


Satoshi Ômura


William C. Campbell

The Nobel Assembly at Karolinska Institute consisting of 50 professors awards the Nobel Prize in Physiology or Medicine since 1901 to scientists who have made the most important discoveries for the benefit of mankind. The Nobel Committee evaluates the nominations and recommends for the award of the Prize. For the year 2015 Nobel Prize for Medicine or Physiology has been awarded to Youyou Tu of China Academy of Traditional Chinese Medicine, Beijing, China, William C. Campbell of Drew University, Madison, NJ, USA and Satoshi Omura of Kitasato University, Tokyo, Japan jointly. Tu, the thirteenth woman to get this prize, is to get half of the prize money of 8m Swedish kronor (£631,000) while Campbell and Omura are to get one fourth each. While Tu was awarded the prize for her discoveries concerning a novel therapy against Malaria, Campbell and Omura were awarded for their discoveries concerning the therapy against infections caused by roundworms. Their contributions in terms of improving human health and reducing suffering are immeasurable.

Diseases caused by parasites have plagued man for millennia and constitute a major global health problem especially for the world's poorest populations. This year's Nobel Laureates have developed therapies that have revolutionized the treatment of some of the most devastating parasitic diseases. Youyou Tu discovered Artemisinin, a drug that has significantly reduced the mortality rates among patients suffering from Malaria. William C. Campbell and Satoshi Ômura discovered a new drug, Avermectin. Avermectin and its derivatives are proved to be efficient in lowering the incidence of River Blindness and Lymphatic filariasis. These two discoveries have provided the man with powerful new means to combat these debilitating diseases that affect hundreds of millions of people annually all over the world.

Man has been suffering from malaria from time immemorial. It is a mosquito-borne disease (primary vectors belonging to Genus *Anopheles*) caused by single-celled protozoan parasites (genus *Plasmodium*), which invade red blood cells, causing fever. In severe cases the brain is damaged and causes death. More than 3.4 billion of the world's most vulnerable citizens are at risk of contracting Malaria, and each year it claims more than 584000 lives, predominantly among

children per year as per the figures from the World Health Organization (WHO). Artemisinin-based combination therapy (ACT) has been considered the best available treatment for the deadly disease and the world owes this to Youyou Tu.

Tu's work stemmed from a secret military project initiated by the Communist Party of China. Chairman Mao Zedong set up a secret mission ("Project 523") in 1967 to find an alternative treatment for malaria, a devastating disease that claimed more lives among the North Vietnamese troops in Vietnam War than the US military. Hundreds of communist soldiers, fighting in the mosquito-infested jungles of Vietnam, were falling ill from malaria, and the disease was also killing thousands of people in the southern China. Chinese scientists were initially unable to use synthetic chemicals to treat this mosquito-borne disease. Thereafter, Chairman Mao's government turned to traditional medicine. In the 1970s, North Vietnam's legendary Communist leader Ho Chi Minh requested Mao Zedong, to encourage research for the development of Chinese medicine against malaria. The government asked the Academy of Traditional Chinese Medicine in Beijing to appoint one of its researchers to scout China's herb garden for a cure.

Tu answered the call of Chinese leader Mao Zedong to find a cure for malaria during the Vietnam War. Tu and her team went through over 2,000 traditional Chinese medicine texts and prepared 380 herbal remedies that they hoped would cure the disease with the findings documented in a notebook called "A Collection of Single Practical Prescriptions for Anti-Malaria." Tu's team found information in a 1,600 year old text which mentioned that people in 400 AD used sweet wormwood (*Artemisia annua* L.), which is known in Chinese as Qinghaosu, to treat malaria with some success. They used this information to create the antimalarial drug.

Malaria was traditionally treated by chloroquine, but with declining success as the parasite was gradually becoming chloroquine-resistant. By the late 1960s, efforts to eradicate Malaria had failed and the disease was on the rise. At that time, Youyou Tu in China turned to traditional herbal medicine to tackle the challenge of developing novel Malaria therapies. From a large-scale screen of herbal remedies in Malaria-infected animals, an extract from the plant *Artemisia annua* emerged as an interesting candidate. However, the results were inconsistent in the trials. Tu revisited the ancient literature and discovered clues that guided her in her quest to successfully extract the active component from *Artemisia annua.* She was the first to show that this component, later called Artemisinin, was highly effective against the Malaria parasite,

both in infected animals and in humans. Artemisinin represents a new class of antimalarial agent that rapidly kill the Malaria parasites at an early stage of their development, which explains its unprecedented potency in the treatment of severe Malaria.

Tu developed unique purification procedure, which rendered the active agent, Artemisinin. The directions in the ancient Chinese literature were to soak one bunch of wormwood in water and drink the juice. Tu realised that their method of preparation, boiling up the wormwood, might have damaged the active ingredient. So she made an alternative preparation using ether solvent. When tested on mice and monkeys, it proved 100 per cent effective. She tried the extract on herself as the first human trial to make sure that it was safe in humans. After enduring no side effects, she organized clinical trials for people with malaria. The first tests in humans were undertaken in 1972 in Hainan when 21 people with malaria were given Tu's preparations. About half had the deadliest form of malaria, caused by *Plasmodium falciparum*, with the rest infected with the most common species *Plasmodium vivax*. The treatments wiped out the parasites in patients with both types of infections within little more than a day. Artemisinin-based combination therapies are recommended by the World Health Organization as the first-line of treatment for uncomplicated malaria and are used in all the Malaria-ridden parts of the world. When used in combination therapy, it has been estimated to reduce overall mortality rate from Malaria by more than 30% in children. In Africa alone more than 100 000 lives are saved every year.

In the past decade the first resistance to Artemisinin has emerged in Cambodia. As of February 2015, Artemisinin resistance has been confirmed in five countries like Cambodia, Laos, Myanmar, Thailand and Vietnam. The drug still works but it takes longer time, four days instead of two. To stop resistance from spreading further doctors now use Artemisinin in combination with another antimalarial drug and it has, therefore, become difficult for the parasite to evolve resistance to two drugs simultaneously.

In 2011, Youyou Tu was awarded the prestigious Lasker prize for medical research. In 2015, the Nobel committee, while awarding the Nobel Prize has said that the award was not honouring Chinese medicine, but for how Tu employed scientific procedures to extract the active ingredient and produce the drug that now saves millions of lives.

The parasitic worms (helminths) are considered medically important that afflict one third of the world's population particularly in the sub-Saharan Africa, South Asia and Central and South America. River blindness

and Lymphatic filariasis are two such important debilitating diseases caused by infection from parasitic worms. In River blindness (Onchocerciasis) chronic inflammation in the cornea leads to blindness. Lymphatic filariasis, with chronic swelling leads to life-long stigmatizing and disabling clinical symptoms, afflicts more than 100 million people all over the world. It causes Elephantiasis (Lymphedema) and Scrotal Hydrocele.

The causative agent of River blindness (Onchocerciasis), *Onchocerca volvulus* is a species of filarial nematode. Black flies (*Simulium*), which breed in rapidly flowing rivers in the affected countries, are the vectors of the disease. The *infected Simulium* releases the larvae (infective-stage) when they bite people to feed on their blood. In the human host, the larvae mature in a nodule under the skin into adult worms. Within a year of infection, females spawn microfilariae. Each female produces approximately 2,000 microfilarae per day during its 14-year life span. River blindness causes intense itching, skin discoloration, rashes, and eye disease often leading to permanent blindness as the microfilariae have a specific affinity for eye tissue and can cluster there to form a lump. Although most microfilariae die before they start reproducing, they cause severe inflammation, in the eyes leading to blindness.

Over the years, millions of acres of fertile agricultural lands in Africa were abandoned by people fleeing river blindness. This flight resulted in hunger and poverty in addition to the physical suffering of infected individuals. Starting in 1974, rivers were regularly sprayed to combat black fly larvae under the auspices of the World Bank's Onchocerciasis Control Program. But the limited treatments available for infected people were more dangerous than the infestations.

Lymphatic filariasis, with chronic swelling leads to life-long stigmatizing and disabling clinical symptoms, afflicts more than 100 million people in more than 70 countries of the world. Considered as a neglected tropical disease by the WHO, the disease is caused by three species of nematodes, viz., *Wuchereria bancrofti, Brugia malayi* and *Brugia timori*. Males (3–4cm long) and females (8–10cm long) together form "nests" in the human lymphatic system. Although majority of infected people are asymptomatic, all of them have subclinical lymphatic damage and in nearly 40% of them kidney is damaged. Microfilariae are transmitted by mosquitoes (Genus : Culex). When a mosquito carrying the larvae takes a blood meal of a healthy individual the parasites are deposited on the person's skin, which then enter the body through the skin. The larvae then migrate to the lymphatic vessels and develop there into adult worms over a period of 6–12 months. The worms, with an

average life span of 6-8 years, produce millions of microfilariae that circulate in the peripheral blood of the host and causes Elephantiasis (Lymphedema) and Scrotal Hydrocele.

Since 1965, the Drug Discovery group at the Kitasato Institute in Japan, under the leadership of Prof Ômura, has undertaken advanced and pioneering research based on the premise that organic compounds produced by microorganisms are useful in improving the health of Mankind. From the novel microorganisms isolated from soil samples, he discovered more than 470 organic compounds with unique chemical structures and bioactivities. Many of these are now widely used as antibiotics, human medicines and agents to improve animal health and husbandry. Prof Ômura through extensive research at the genetic level has made it possible to manipulate living microorganisms to produce novel compounds.

Professor Satoshi Ômura, a Japanese microbiologist, is globally recognized as an expert in the field of Bioorganic Chemistry, particularly for the discovery, development, biosynthesis and manipulation of useful chemicals derived from naturally-occurring microorganisms. By applying highly original methods of isolation, he has discovered 13 novel genera and 42 new species of useful microorganisms. With his expertise in isolating natural products, Satoshi Ômura worked on a group of bacteria, *Streptomyces*, which lives in the soil producing a plethora of agents with antibacterial activities including Streptomycin which was discovered by Selman Waksman (who was awarded Nobel Prize in 1952). Ômura isolated new strains of *Streptomyces* from soil and successfully cultured them in the laboratory by developing unique methods for large-scale production. From thousands of different cultures, he selected nearly 50 most promising ones for further analysis for their activity against harmful microorganisms. Among the various strains he isolated was *Streptomyces avermitilis* from the local golf course, which appeared highly effective and became the source of Avermectin.

Prof Omura has been the recipient of several prestigious awards like Japan Academy Prize, Tetrahedron Prize, Arima Award, Gaidner Global Health Award etc. before becoming a Nobel Laureate.

William C. Campbell, a parasitologist from USA, acquired the *Streptomyces* cultures from Ômura and explored their efficacy. He discovered a component from one of the cultures of *Streptomyces* to be remarkably efficient against parasites in domestic and farm animals. The bioactive agent was purified and named Avermectin. This was later chemically modified to form a more effective compound called Ivermectin, a semi-synthetic derivative of one of these Avermectins. The

drug was marketed for veterinary use in the early 1980s and was extraordinarily profitable. In 1982, Merck and the World Health Organization (WHO) began studying the effects of Ivermectin on parasites in humans and the compound turned out to be highly effective in both animals and humans against a variety of parasites, including those responsible for River blindness and Lymphatic filariasis. The compound was tested in humans with parasitic infections and found to effectively kill the microfilariae.

One annual dose of ivermectin paralyzes the larvae and mature worms and prevents them from moving around in the skin and other tissues of the infected person. The worms' paralysis lasts for a year, during which there is no spawning. Each year, a fresh dose of the drug is given and after 15 years, the life cycle of the worm is broken. In nematodes, the γ-aminobutyric acid (GABA) receptors are located in the neuromuscular junction. Ivermectin binds to neuronal membranes and increases the release of GABA, which then binds to the GABA receptor-chloride channel complex of postsynaptic neuronal membranes leading to an influx of chloride ions. This hyperpolarizes the neuronal membranes, decreases nerve transmission and results in paralysis.

In 1987, the Chairman and CEO of Merck announced that the company would donate Mectizan (Merck's ivermectin) for the treatment of river blindness to all those who needed it and for as long as needed. This donation brought about one of the most successful public-private partnerships in history and Merck has provided Ivermectin for the treatment of more than 200 million people in 33 countries since 1987.

The discovery of Avermectin and its derivative Ivermectin has abruptly changed the treatment of parasitic diseases and are proved highly effective against a range of parasites with very limited side effects. The importance of Ivermectin for improving the health and wellbeing of millions of individuals with River Blindness and Lymphatic filariasis, primarily in the poorest regions of the world, is immeasurable. Treatment is so successful that these diseases are on the verge of eradication. By 2010, the treatments have reached 100 million people. In Ecuador the disease has been declared extinct. Elsewhere huge numbers of people have been freed from the disease, and have returned back to fertile areas near rivers. Thus the contributions of Ômura and Campbell led to the discovery of a new class of drugs with extraordinary efficacy against diseases caused by helminth parasites. In the recent years both Ivermectin and Artemisinin have been included in the WHO's list of essential medicines and are distributed free or at low cost.

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Two share nobel in Physics 2015 for decoding elusive neutriono

Arthur McDonald's **Takaaki Kajita**

A Japanese and a Canadian scientist won the 2015 Nobel Prize for Physics for discovering that elusive subatomic particles called neutrinos have mass, opening a new window onto the fundamental nature of the universe.

Neutrinos are the second most bountiful particles after photons, which carry light, with trillions of them streaming through our bodies every second, but their true nature has been poorly understood.

Takaaki Kajita and Arthur McDonald's breakthrough was the discovery of a phenomenon called neutrino oscillation that has upended scientific thinking and promises to change understanding about the history and future fate of the cosmos.

In awarding the prize, the Royal Swedish Academy of Sciences said the finding had "changed our understanding of the innermost workings of matter and can prove crucial to our view of the universe".

For many years, the central enigma with neutrinos was that up to two-thirds fewer of them were detected on Earth than expected, based on how many should be flooding through the cosmos from our Sun and other stars or left over from the Big Bang.

Around the turn of the millennium, Kajita and McDonald, using different experiments, managed to explain this by showing that neutrinos actually changed identities, or "flavors", and therefore must have some mass, however small.

McDonald told a news conference in Stockholm by telephone that this not only gave scientists a more complete understanding of the world at a fundamental level but could also shed light on the science behind fusion power, which causes stars to shine and could one day be tapped as a source of electricity on Earth.

"Yes, there certainly was a Eureka moment in this experiment when we were able to see that neutrinos appeared to change from one type to the other in traveling from the Sun to the Earth," he said.

McDonald is professor emeritus at Queen's University in Canada, while Kajita is director of the Institute for Cosmic Ray Research at the University of Tokyo.

Kajita said his work was important because it showed there must be a new kind of physics beyond the so-called Standard Model of fundamental particles, which requires neutrinos to be massless.

The final piece of the Standard Model was slotted into place in 2012, with the detection of the Higgs boson particle at CERN's Large Hadron Collider outside Geneva. But it is now clear that the model does not provide a complete picture of how the fundamental constituents of the universe function.

While McDonald and Kajita have cracked a key part of the puzzle, other questions remain, including the exact masses of neutrinos and whether different types exist beyond the electron-neutrinos, muon-neutrinos and tau-neutrinos identified so far.

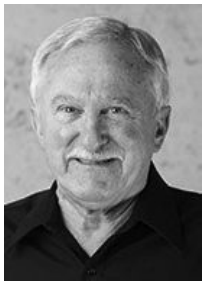
Courtesy : The HINDU, October 7, 2015 (Separate article to be published in November issue).

NOBLE PRIZE IN CHEMISTRY 2015

Prof. G. B. N. Chainy

Noble prize is the most prestigious international award given to persons for their excellent achievements in the field of physics, chemistry, literature and physiology or medicine. The award was instituted by Alfred Noble, a Swedish citizen in the year 1901 from the interest incurred by a trust constituted by Noble. Besides, the award is also given in the field of economics and peace. The chemistry Noble prize is announced on October, 7 of every year by a press release made by Noble Foundation, Sweden. This year the prize was awarded to Thomas Lindhal, Paul Modrich and Aziz Sancar for their pioneer contributions to the field of DNA repair.

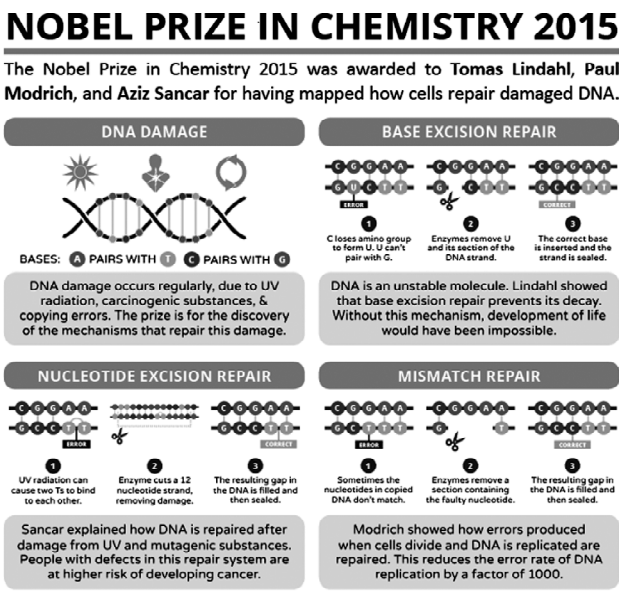
Thomas Lindhal



Paul Modrich

Aziz Sancar

DNA is the genetic material of all cells. It contains genetic information used for development, functioning and reproduction of all cells. The double helical structure of DNA was first proposed by James Watson and Francis Crick. Both were awarded Noble prize in Physiology or Medicine along with Maurice Wilkinson in the year 1962. Generally, DNA is a double-stranded helical structure. The strands run anti-parallel to each other. DNA structure contains a back bone of phosphate and sugar. Nitrogenous bases such as purines (adenine, guanine) and pyrimidines (cytosine and thymine) are joined to sugar molecules of the backbones of strands and are faced inward. Nitrogenous base of one strand pairs with nitrogenous bases of the strand through hydrogen bonds. The bonding follows a precise rule. Adenine always bonds with thymine and cytosine always bonds with guanine. This chemical and physical structure of DNA molecule is universal in nature. So how DNA of two different species differ from each other? They differ from each other by two ways. First, how many base pairs they contain and secondly how base pairs are arranged in the DNA molecule. Up to early sixties people were of the opinion that DNA molecule is very stable in nature and rarely any damage could happen to it. By 1970 scientists realized that DNA in cell is prone to damage as a consequence of various chemical processes such as hydrolysis, oxidation, alkylation (non-enzymatic methylation of DNA bases) and bulky adduct formation. Some of damages occur endogenously by reactive oxygen species, a by-product of metabolic activities whereas external agents such as radiations, heat, chemicals may also damage DNA molecules. These damages of DNA are considered as major cause for mutation, cancer and



aging. The magnitude of damage can be judged from the fact that the DNA damage events take place every day in a tune of about 10000 times per cell. But in general DNA of a cell maintains its integrity and passes from one generation to the other keeping intact its biological and chemical properties. So the idea muted in the minds of scientists that the there should be a very efficient system in cells to identify the damage and to repair it. Damages occur to DNA can broadly be classified into three major types. They are Base Excision Repair (BER), Nucleotide Excision Repair (NER) and Mismatch Repair (MMR). In BER, damaged base is removed from the DNA molecule. Nucleotide Excision repair also removes a damaged base from DNA molecule by removing a long patch of DNA containing defective base. The Mismatched Repair System is stranding specific. During DNA synthesis in a cell, several errors occur due to incorporation of faulty bases in the newly synthesized DNA. Mismatch Repair System not only identified mismatched bases in the newly synthesized DNA but also removes the same and incorporates the correct base. Thus it maintains DNA integrity. Each repair system has its unique enzymes and proteins to carry out the repair work.

Prof. Thomas Lindhal, FRS is born in Sweden. He noticed the phenomenon of damage of DNA in cells. He discovered base excision repair pathway. He is presently working in Francis Crick Laboratory and Clara Hall Laboratory, UK. Prof. Paul L. Modrich discovered the mechanism of mismatch repair pathway. He is from HHMI and Duke University NC, USA. And Aziz Sancar, a Turkey-born USA scientist has made seminal contribution to understand the mechanism of Nucleotide excision repair (NER) system. He is working at University of North Carolina, USA. The fundamental contributions made by them made us to understand how a living cell maintains integrity of its genome. Also there contributions in understanding various DNA repair systems open a new insight to develop new drugs to fight cancer. In summary, they demonstrated that cells have tool kits to repair their damaged DNA. For their invaluable contribution to science, Noble Prize was awarded to them for mechanistic studies of DNA repair.

(to be continued)

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Department of Biotechnology, Utkal University, Bhubaneswar

LARGE HADRON COLLIDER (LHC)

Dr. Sodananda Torasia

Introduction

Once famous for its brillant objective, grand design, gigantic size, unique location, vast investment, worldwide participation of huge scientific manpower, unprecedented international cooperation, half a century of pursuit followed by decade long devoted research in giving shape to LHC, it culminated with the world famous discovery of Higgs Boson, popularly called God Particle. After the euphoria, leading to the award of the Nobel prize, there appeared to be a lull in the activity of LHC. However, with the indomitable spirit, the scientists were planning for it bigger objectives to meet the faint questions lurking in their minds regarding the confirmation of the discovery in attending cent percent accuracy, so that they could answer the questions, which arose from the events and to take them nearer to the origin of the Big Bang and help them wade through the primordial fluid in search of new particles in their formative stage.

The Large Hadron Collider (LHC) of CERN is the largest and most powerful particle accelerator in the world. The accelerator is in a circular tunnel of 27 kilometers in circumference under the Jura Mountain in Switzerland and France border. This sophisticated machine is designed to provide interactions between beams of protons at extremely high center-of-mass energy of 14 TeV and lead ions of 5.5 TeV per nucleon. The counter-rotating beams are accelerated by means of radio-frequency (RF) cavities and guided and focused using superconducting magnets. The superconducting magnets are equipped with comprehensive cryogenic system, which operate at a temperature of 1.9 degrees above the absolute zero. The beam channels are maintained at high vacuum, as it should be free of gas.

During the first phase of LHC running (called Run I), the machine delivered proton-proton colliding beams at 0.9, 2.76, 7 and 8 TeV, lead-lead collisions at 2.76 TeV, and proton-lead collisions at 5 TeV. It was a long wait for the start of Run I, which is about twenty years after the first concept of LHC and the experiments. Run I started in the year 2009 and lasted till the first quarter of 2013. This was the end of an era for the LHC where we got our first glimpse of a new energy scale, and gathered enough data to discover the Higgs Boson.

Indian scientists have been involved in the cutting-edge research at CERN. Funded by the Department of Atomic Energy and Department of Science and Technology, our scientists have made significant contributions to CERN in terms of construction of the accelerator components for the Large Hadron Collider (LHC) and

ALICE-India team at the ALICE Run Control Center at CERN with ALICE Deputy Spokesperson and Run Coordinator.

participation in two major experiments: ALICE and CMS. While the CMS experiment is searching for the signatures of Higgs Boson and trying to understand its details, the main goal of the ALICE experiment is to understand the nature of the hot and dense matter in the form of Quark Gluon Plasma (QGP) that existed within few microseconds after the Big Bang.

During the technical stop of LHC from March 2013 till middle of 2015, the LHC team worked hard for the start of Run II, to start with a beam energy which is higher compared to that of the Run I and with higher beam luminosity. Run II started on 3rd June 2015 with proton-proton collisions at center of mass energy of 13 TeV, which is the energy never achieved by any accelerator so far. This new energy level opens up new horizons for physics and discoveries.

Four large experiments, ALICE, ATLAS, CMS and LHCb, also underwent major work for Run II during the technical stop. During this time, important maintenance work and up-gradation were done. The experiments were fully ready to use the beam at the start of the Run II of LHC.

The second phase of LHC (Run-II) started on 3rd June 2015 at 10.10AM. The beam energy reached a record 13 TeV for proton-proton collisions and the data run started soon after. The ALICE-India team was present in the ALICE Run Control Center for the start of the experiment. The team has been at CERN

for the smooth startup of the Photon Multiplicity Detector (PMD), which has been the sole responsibility of the Indian groups. PMD has been taking data since then. It has been an amazing experience today at the control room.

During Run II, several billion proton collisions and lead ion collisions could occur every second in the detectors. Several hundred particles are produced in each proton-proton collision, whereas several thousands of particles are produced in each lead-lead collision. These particles leave their marks on the detectors, which are readout by front-end electronics boards. Onboard computers process these data and send to large storage systems. Most of the collisions do not yield interesting results, and at the same time it is not possible to store all the data. Trigger systems of the experiments sort the quality of the data and keep only the most interesting events, which is between few hundred to few thousands per second. The data are sent to Worldwide LHC Computing Grid (WLCG) and further analysis.

ALICE-India collaboration consists of members from 14 Institutes and Universities, and has nearly 100 scientists including 50 Ph.D. scholars.

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* The author is thankful to Dr. Tapan Nayak, Prof. VECC, Kolkata, a collaborator in ALICE-INDIA team, for some valuable inputs for this article.

RESINS-PRECURSORS OF PLASTICS

Prof S. K. Mohapatra

Resin comes from the Latin word "Resina" and from the French word "Resine". It broadly refers to thick, viscous, sticky and inflammable chemically homogeneous, organic substances. Also any component of a liquid that will set into a hard lacquer or enamel like finish is called as resins. They can be classified as natural or synthetic resins.

Natural Resins

Most natural resins are transparent or translucent yellowish brown secretions from coniferous plants such as pine and fir, when their barks are injured. They are mainly bi and tri- cyclic terpene hydrocarbons with small amounts of volatile phenolic compounds different from sap and latex in their chemical composition. They dry up into solid granules when the volatile components are removed. They have apparently no role in the primary physiology of the plants. Many scientists believe they are waste products and probably protect the plants from insects and pathogens by their toxic nature.

Natural resins are classified as spirit soluble and oil soluble resins. The spirit soluble ones are shellac, mastic, damar, sandrac, kauri and amber. These find extensive use in preparation of varnish and lacquers. The oil soluble resins include Rosins and their

derivatives and are used in soap making and copals in varnish making. Resins containing benzoic acid and cinnamic acid are called "balsams" are popularas healing agents.

Natural resins particularly "frankincense" and "myrrh" have a long history, well documented by Pliny, the elder of Rome in ancient times, Italians and Greeks used to seal boats, food containers and preserving mummies. They were highly prized substances as incense in religious rites and the fossilized ones as amber in jewellery.

Synthetic Resins

Synthetic resins are chemically different from resins secreted by the plants. They have only some of the physical properties of interest to natural resins. Addition of unsaturated hydrocarbons or condensation of urea, melamine with phenols, glycols produce resins, which when are allowed to polymerise, they turn into plastics. In general the products of condensation are thermosetting resins and the products of addition are thermosetting resins. Thermosetting plastics such as poly methyl methacrylate, are often loosely identified as resins. In case of such plastics the true resin is the liquid monomer methyl methacrylate before polymerisation. In case of copolymers one of the monomers has to be considered as resin and the other monomer as a hardener (exa- epoxy resindescribed later). However, these are named as resins because they solidify in the same way as some plant resins.

Uses of Resins

Urea formaldehyde, melamine formaldehyde resins are used as adhesives for the bonding of ply wood, decorative paneling and other structural and wood products. They could be strengthened and tinted by pigments to make light,thin, hard, strong colourful translucent articles for home and kitchen. Its electrical resistance makes it desirable for products such as switch plates. Melamine formaldehyde resins have almost replaced theurea formaldehyde resins, because they are clear, hard and chemical and moisture resistant and find extensive use as laminated table tops ,dish ware, table ware and automotive surface coatings for automobile tops and finishes of appliances and metal furnitures.

Phenol formaldehyde with excess formaldehyde produces a low molecular prepolymer "resole" which inliquid form or in solution is used in sandwiching layers of wood veneer to form ply boards. On the otherhand the resin with excess of phenol forms the prepolymer "novolac", used to make heat resistant and insulating objects such as brake lining, and appliance handles because of its good moisture resistance.

All condensation products are oil soluble and are used for making varnish, enamels, lamination and adhesives, impregnating electric coils for insulation and as binders. Layers of canvas, fabrics, paper coated with resin varnish, laid one over anotherproduce

laminations, strongboards with water resistant and superior insulating properties which are used forpanels and plates.

Poly propylene resins as fibers are used as major constituent in fabrics for home furnishings such as upholstery and carpets, ropes, diapers. Foamed polystyrene is used for making food containers such as beverage cups, egg cartoons and disposable plates and trays. Cellulose based resins are transparent and are used for wrapping objects and sealing caps. Chlorinated chloro- sulphonated poly ethylene's are resistant to oxidation and attack by ozone and are, therefore, used for making hoses, belts, and heat resistant seals.

Ion-Exchange resins-

Styrene divenyl benzene copolymer carrying carboxylic or sulphonic acid or quarternary ammonium group are porous solid beads or granules, used for removal of calcium, magnesium, iron and manganese ions from water (softening) like zeolites, purification of sugar and concentrate valuable elements such as gold, silver and titanium from mineral ores, catalysis of organic reactions. Certain ion exchange resins are also used pharmaceutically as bile acid sequestrantsand hypolipidemic agents.

Modern Resins

Epoxy resins, obtained from epinchlorohydrin and bis-phenol or glycerol having a terminal glycydyl lether structure have many hydroxyl groups and cures readily with amines are used as surface coatings for tanks, pipes, aircraft parts, as adhesives and lamination. Poly- urethane or isocyanate resins obtained from toluene di-isocyanate with diols are characterized by toughness and resistance to chemical action. Therefore, they areused as adhesives, and water proof composites and in industrial flooring and interior colouring. Poly carbonate resins are used in molded products such as dentures and ball bearings.Tetra flouro ethyleneresins in the form of fibres are used for packing, electrical insulation. Rosin (solidified resin from which volatile terpenes have been removed and dissolved in alcohols, essential oils) are used to the bows of musical instruments for increase sound quality by adding friction.

Resin C is a neutral coal tar resin of high styrene content is used to impart grease and alkali resistance to floor tiles. Pyro-xylene (cellulose tetranitrate) is used as an adhesive and making collodion in ether or alcohol for cementing, coating wounds and abrasives, solvent for drugs, corn removers, and artificial pearls.

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CONSERVATION AND MANAGEMENT OF WILDLIFE RESOURCE IN ODISHA

Dr. Bijay Ketan Patnaik

Odisha, a beautiful State is situated along east coast of the country, bordering 480 kms of coast line with numerous hills, hillocks, myriads of waterfalls and varied biodiversity extending over four Bio-geographic zones i.e., Northern plateau, Eastern Ghats, Central Table Lands and Coastal Plains.

The broad physical features of the state include coastal plains, the middle mountainous region, the rolling uplands, the river valleys and subdued plateaus. Most of the forest belongs to two broad types i.e. tropical moist deciduous and tropical dry deciduous forests. However, there are other types which are very distinct in their nature and character and they constitute distinct botanical areas within and outside the above broad groups. They are semi-evergreen forests, littoral swamps and mangroves. The mangroves (total area 205 sq. km as per S.F.I. Report, 2011) although occuring in a very small area along the Brahmani Baitarani delta and Mahanadi delta constitute one of the most important forest types. The bio-diversity of this forest types in Odisha is considered to be better than any such area in the Indian mainland. Different types of forests provide ideal habitats for a large variety of wildlife, both aquatic and land-based ones including the arboreal as well as the transitional amphibious forms.

Protected Areas of State

Nineteen Sanctuaries, one National Park (Bhitarkanika) duly notified under Wildlife (Protection) Act, 1972 and one proposed National Park (Similipal) constitute the Protected Area Network of Orissa that covers 8333.61 sq.km of land area which is 5.35% of the geographical area and 14.33% of the forest area of the state. Added to this is also a stretch of 20 km wide marine habitat of 1408 sq.kms of seascape in Gahirmatha Marine Sanctuary. People's protection effort of Blackbuck in Betnoi-Balipadar area of Ganjam district was taken into cognigance and one Blackbuck community Reserve has been proposed in Ganjam district.

Bhitarkanika was constituted as the first sanctuary in the State under the provisions of Wildlife (Protection) Act, 1972, and was notified in April, 1975. Other Sanctuaries to follow were Satkoshia Gorge Sanctuary (1976), Hadgarh (1978), Similipal and Nandankanan (1979), Baisipalli and Kotagarh (1981), Chandaka, Karlapat and khalasuni (1982), Kuldiha and Balukhand (1984), Lakhari and Debrigarh (1985), Badrama and Chilika-Nalaban (1987), Sunabeda (1988) and Gahirmatha Marine Sanctuary (1997). Similipal was finally declared as a sanctuary under Section 26 of wildlife (Protection) Act during April, 2008 only.

The Bhitarkanika National Park was finally notified in the year 1998, and the notification of Similipal proposed national Park was issued in two phases in 1980 and in 1986. The Wildlife (Protection) Act 1972, the Forest Conservation Act, 1980 and the Environmental (Protection) Act, 1986 as amended from time to time have provided necessary legal support for conservation of the forests as well as Wildlife.

Faunal Diversity : The state is blessed with an extremely rich and unique assemblage of wildlife, inhabiting their respective habitats spread over three different bio-geographic zones (Décan peninsula, Gangetic plains and Coast). Different ecological riches display interesting groups of wildlife in Orissa. There are 20 species of amphibians, 110 species of reptiles, 479 species of birds and 86 species of mammals so far identified and listed in our state in addition to large varieties of fish (about 300 species fresh water, estuarine and marine and marine) and invertebrate fauna. According to IUCN RED DATA BOOK-1997 the threatened species of Reptiles, Birds and Mammals in Orissa include 17 species (Reptiles), 15 species (Birds) and 22 species (Mammals), respectively.

Some of the important animals seen in Odisha are :

Mammals : Tiger, Leopard, Wild dog. Wolf, Elephant, Bison, Nilgai, ratel, Sloth-bear, Wildboar, Sambar, Spotted Deer, Barking Deer, Mouse deer, Blackbuck, Four-borned Antelope, Dolphins.

Bird : Peafowl, Red-jungle fowl, Malabar Pied Hornbill, Gull, Fishing eagle, Adjutant Stork, Spoonbill, Jacana, Lapwing.

Reptiles : King Cobra, Python, Mono-cellate Cobra, Bi-cellate Cobra, Marine turtles like Olive Ridley; Freshwater turtles like Ganges soft -shelled turtle, Chitra Turtle; and Tortoises like Star Tortose, Elongated Tortoise; all three species of Indian Crocodilians; limbless skink; Fat- tailed Gecko; Indian chameleon; Water monitor, Yellow Monitor etc.

Fish: Mahashir of hill streams, Freshwater Shark.

One of the premier 'large' Zoos of the cournty, the Nandankanan Zoological Park, was established in 1960 over an area of 3.62 sq. kms. in a natural setting. The zoo has 1291 animals of 130 species (508 mammals of 48 species, 688 birds of 58 species and 95 reptiles of 24 species) ; housed in 98 enclosures (Cages-60, moated-38). The White Tiger Safari, Lion Safari, Aquarium, Aviary, Orangutan, Chimpanzee, Gharial breeding facility, Toy Train, Boating and Aerial ropeway are some of the prime attractions of this Zoo.

Wild Animal Conservation Programmes

'Similipal' was chosen as one of the nine prime locations for tiger conservation under the 'Project Tiger' launched in the year 1973 in the country. In a span of three decades Similipal Tiger Reserve has emerged as a leader in tiger management and monitoring. Here the tiger population has increased more than 3-fold, (from 30 in 1975 to 101 in 2004)*;

* Recent estimation of tiger population in the country, done by Wildlife Institute of India, Dehradun by using camera trap method, the tiger population inside Similipal Tiger Reserve is estimated at 20 only.

and an array of biodiversity features has received protection under the umbrella of tiger conservation. Project Tiger in Similipal has been a beacon for most other wild life management activities in the state. New area/ habitat with potentiality for tiger conservation in the state such as Satkoshia Gorge wildlife Sanctuary has been notified as second Tiger Reserve, and Sunabeda Wildlife Sanctuary has been identified and agreed in principle to be designated as the third Tiger Reserve under the Project Tiger.

A different aspect of tiger conservation is the string of efforts put to generate a population of white tigers. After the birth of white tiger cubs in Nandakanan in January, 1980 to parents appearing normal in colour, a systematic breeding programme was implemented. The Zoo holds the largest collection of white tigers (now, 10) in any zoo of the country. These white tigers have been used to procure rare animals from other zoos in the country.

The crocodile conservation programme was launched in the state in 1974-75 and Research Centers have been established at various strategic locations of the state.

The Gharial species, once apprehended for 'facing imminent extinction' has now a very successful breeding record in captivity and a good chance of survival if suitable wild habitats can be delineated. But Gharial conservation programme at Satkosia gorge at Tikarpada has so far not shown any encouraging result. The saltwater crocodile, designated as 'endangered in 1975' has now a viable population of about 1661 in the river systems of Bhitarkanika Sanctuary and associated areas /habitats, the most promising place for these crocodiles in the entire country. The sighting of crocodile nests in the sanctuary has gone up from only 6-7 nests in the eighties to over 75 at present. The Mugger concluded 'to be depleting faster than it could reproduce' has well established breeding centers in Nandankanan and Ramatirtha, and its population has gone up above 60 in the Satkoshia Gorge. The number of Mugger crocodiles in Satkoshia Ramtirtha Similipal and Ghodadiha reservoir of Ganjam district is 81,82 and 48 respectively as per 2012-13 Census.

Elephant conservation programme under project Elephant was launched in the year 1991. Three Elephant Reserves (ERs), namely

1	Gharial Research and Conservation Centre	1975	Tikarpada (Satkoshia Gorge Wildlife Sanctuary)
2	Saltwater Crocodile Research & Conservation Centre	1975	Dangmal (Bhitarkanika Wildlife Sanctuary National Park)
3	Mugger or Marsh Crocodile Research & Rehabilitation Centre	1979	Ramatirtha (Similipal Wildlife Sanctuary)
4	Captive Breeding of three crocodilians	1976	Nandakanan (Nandakanan Wildlife Sanctuary)

Mayurbhanj ER, Mahanadi ER and Sambalpur ER were notified in the years 2001 and 2002 to offer more focused protection to about 50% of the state's elephant population using 8509 sq.km. The ER-Network is being expanded to 14884 sq.kms of forest habitat to offer protection to over 90% of the 1930 elephants now inhabiting the state. (2012-13 Census). Another survey conducted during March, 2015, has shown slight increase in their numbers making it to 1957.

Sea turtle conservation was started in the year 1976. About 50% of the total world population of Olive Ridleys that equals to about 90% of the Indian population of sea turtles use the Odisha coasts for nesting. The nesting intensities of sea turtles are monitored and the Gahirmatha Marine Sanctuary has been constituted for protection of turtles using the main nesting beach. The Coast guards, State Fisheries Department, Home Department and the FAO/UNDP and several NGOs have been brought in to collaborate in turtle conservation activities.

The constitution of Similipal Biosphere Reserve over an area of 5569 sq.km in 1994 is an additional support to the management inputs started in the year 1973 under Project Tiger and the sustenance of the same under the State Wildlife Organization.

Besides these, there are certain areas which are outside sanctuaries and protected areas, but very important from wild life point of view. These areas include traditional zone of Similipal Biosphere Reserve elephant movement areas outside declared elephant reserves, conservation reserves and community reserve areas and sea Turtle nesting /breeding areas outside Gahirmatha Marine Sanctuary. During the year, 2009 a new project titled "National resource Conservation outside Protected- Areas" has been approved for launching in collaboration with Govt. of India and UNDP.

Wildlife Population

Due to effective protection measures over last few years, the wildlife population has increased in most of the Protected Areas and also in other wildlife areas of the state. It is not becoming possible to conduct census of all the species of wildlife in the state but the census result of a few endangered /flagship species indicate that the population is showing an increasing trend.

Protection measures

The question often asked is 'why should the Wildlife be preserved? Do they not destroy crops and hill cattle and human beings?' Preservation of Wildlife does not mean the blind protection of all wild creatures at all costs. Wildlife management implies protection, conservation and scientific management of the wild animals. The value of wildlife in maintaining the balance of nature (i.e. Biome) is of considerable importance.

Protection measures have been effectively worked out through various ways and means including VHF network system, deployment of mobile squad, Sabuj Bahini (Peoples participation) and intelligence collection, etc. within the limited manpower and resources. Construction of watch towers

Population estimate of some prominent wildlife species (2011-12 and 2012-13)

Sl. No.	Species	Census area /site	2011-12	2012-13
1	Saltwater crocodile	Bhitarkanika river system	1659	1661
2	Mugger crocodile	Satkoshia Mahanadi river system	81	76
		River system of Similipal Tiger Reserve	82	80
3	Gharial	Mahanadi river system	02	02
4	Olive ridley sea turtle	Gahirmatha	1.68 lakhs	4.06 lakhs
		Rushikulya	4.01 lakhs	2.88 lakhs
5	Irrawaddy dolphins	Chilika	145	152
6	Blackbuck	Balukhand-Konark Bakipadar-Bhetnoi	13	22 (estimated)
7	Elephant	Entire Orissa	-	1930
8	Tiger**	-	-	-
9	Leopard**	-	-	-
10	Migratory birds	Chilika lagoon	8.68 lakhs of 106 species	8.62 lakhs 112 species
		Bhitakanika Mangrove Wetland	0.53 lakh of 118 species	0.82 lakh of 111 species
		Hirakud Reservoir	0.47 lakhs of 52 species	0.79 lakhs of 59 species

*As per 2010-11 census there were 2181 Blackbuck in Balipadar Bhetnoi areas of Ganjam district. But in subsequent years, bulk of them migrated to other nearby areas after phylin.

** As per January, 2004 census there were 192 Tigers (57 male, 75 females and 60 cubs) and 487 leopards in the state. (Pugmark method)

at strategic locations inside the wildlife habitats, establishment of anti-poaching camps and provision of saltlicks have helped to improve wildlife status. Protection measures are also being taken with the help of Police, Fisheries Department, Coast Guard and Indian Navy to protect the endangered sea turtles both on shore and off shore of Orissa Coast. Steps are being taken to involve the public in the management of wildlife for tackling the man-animal conflict and to reduce pressure on wildlife habitats /forests through eco-development programme and beneficiary oriented schemes. Wildlife education and interpretation programme have been imparted to the public through suitable interpretive methods including audio-visuals. Eco-friendly tourism /Eco-tourism is also being promoted in the protected areas for generating support for conservation of wildlife resource of the state.

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OIL SPILL: A THREAT TO THE MARINE ECOSYSTEM

Prof. Madhumita Das

Introduction

Our planet, Earth, has large reserves of oil and gas trapped deep beneath its surface. Rarely, these reserves develop cracks and some of the oil or gas seeps out. However, this is a part of natural phenomenon and rarely it causes any major damage. On the other hand, there are times when the same problem caused due to human involvement leads to a great deal of damage to marine ecosystems. In the last thirty odd years, the issue of oil spills and their effects has got a great deal of significance. This is because when an oil spill occurs, it causes a multitude of problems for the marine environment and the society. For centuries people have regarded oceans as an inexhaustible supply of food, a useful transport route, and a convenient dumping ground. But this human activity, particularly over the last few decades, has finally pushed oceans to their limit.

Oil spill is nothing but leakage of petroleum onto the surface of a large body of water. Natural disasters like hurricanes, tsunami may cause an oil spill by flipping an oil tanker over, causing oil to come pouring out. Illegal entrepreneurs dump crude oil into the ocean because they don't want to spend money on decomposing their waste oil. Oil spills may be due to releases of crude oil from tankers, offshore platforms or drilling rigs and wells, as well as spills of refined petroleum products (such as gasoline, diesel) and their by-products. Oil spills happen when people make mistakes or are not careful and cause an oil tanker to leak oil into the ocean. Oceanic oil spills became a major environmental problem in the 1960s, chiefly as a result of intensified petroleum exploration and production on continental shelves and the use of supertankers capable of transporting more than 500,000 metric tons of oil.

Spectacular oil spills from ruined or damaged supertankers are now rare because of stringent shipping and environmental regulations. Nevertheless, thousands of minor and several major oil spills related to well discharges and tanker operations are reported each year, with the total quantity of oil released annually into the world's oceans exceeding one million metric tons. The accidental or careless release of used gasoline solvents and lubricants by industries significantly aggravates on the whole the ecological problem. Combined with natural seepage from the ocean floor, these sources add oil to the world's waterways at the rate of 3.5 million to 6 million metric tons a year.

What happens after an oil spill ?

Oil floats on saltwater in the ocean and rarely if the oil is very heavy , it can sink. Oil usually spreads out rapidly across the water surface to form a thin layer that we call an oil slick. As the oil continues spreading, the layer becomes thinner and thinner, finally becoming a very thin layer called a sheen, which often looks like a rainbow.

Fig.1 Sea otters covered in sticky black oil

Depending on the circumstances, oil spills can be very harmful to marine birds and mammals and also can harm fish and shellfish. Specially this is harmful to birds and sea otters. Oil destroys the insulating ability of fur-bearing mammals, such as sea otters, and the water-repelling abilities of a bird's feathers, thus exposing these creatures to the harsh elements. Many birds and animals also swallow oil when they try to clean themselves, which can poison them. Oil spills at sea are generally much more damaging than those on land, since they can spread for hundreds of nautical miles in a thin oil slick which can cover beaches with a thin coating of oil. This can kill sea birds, mammals, shellfish and other organisms it coats.

Fig.2 A leaking oil tanker causes an oil spill in the ocean

Sources of oil coming to the ocean

Oil wastes that enter the ocean come from many sources, some being accidental spills or leaks, and some being the results of chronic and careless habits in the use of oil and oil products. Most waste oil in the ocean consists of oily drainage from cities and farms, untreated waste disposal from factories and industries, and unregulated recreational boating. The table below (Table-1) gives an idea about the sources of oil coming to the ocean.

Table-1 : The sources of oil coming to the ocean

Sl. No.	Source of oil entering the Ocean	Appx. % of total oil spill
1.	Land drainage and untreated waste disposal	50
2.	Offshore drilling and production operations, spills or leaks from ships or tankers	8
3.	Routine maintenance of ships	20
4.	Hydrocarbon particles from onshore air pollution	13
5.	Natural seepage from the seafloor	8

How oil spills are cleaned up ?

Spills may take weeks, months or even years to clean up. Oil spills penetrate into the structure of the plumage of birds and the fur of mammals, reducing its insulating ability, and making them more vulnerable to temperature fluctuations and much less buoyant in the water. Cleanup and recovery from an oil spill is difficult and depends upon many factors, including the type of oil spilled, the temperature of the water (affecting evaporation and biodegradation), and the types of shorelines and beaches involved.

Once oil has spilled, government agencies as well as volunteer organizations may respond to the incident. There are several methods for cleaning up of oil spill. To decide which method to be adopted depends upon the weather, the type and amount of oil spilled, how far away from shore the oil has spilled, what kinds of bird and animal habitats are in the area, and other factors. Different cleanup methods work on different types of beaches and with different kinds of oil. For example, road equipment works very well on sandy beaches, but cannot be applied in marshes or on beaches with big boulders or pebble.

1. Booms, which are floating barriers to oil (for example, a big boom may be placed around a tanker that is leaking oil, to collect the oil).
2. Skimmers, which are boats that skim (scoop) spilled oil from the water surface.
3. Sorbents or sponges (e.g., straw, volcanic ash, and shavings of polyester-derived plastic) that absorb the oil from the water. Chemical dispersants and biological agents, which break down the oil into its chemical constituents.
4. In situ burning, which is a method of burning freshly spilled oil, usually while it's floating on the water.
5. Washing oil off beaches with either high-pressure or low-pressure hoses.
6. Vacuum trucks, which can vacuum spilled oil off of beaches or the water surface.
7. Shovels and road equipment, which are sometimes used to pick up oil or move oiled beach sand and gravel down to where it can be cleaned by being tumbled around in the waves.
8. Bioremediation:Use of microorganisms (such as the bacteria Alcanivora or Methylocella) or biological agents to break down or remove oil.
9. Bioremediation Accelerator: Oleophilic, hydrophobic chemical, containing no bacteria, which chemically and physically bonds to both soluble and insoluble hydrocarbons. The bioremediation accelerator acts as a herding agent in water and on the surface, floating molecules to the surface of the water, including solubles forming gel-like agglomerations.

Examples of large oil spills

Oil tankers are only one source of oil spills. On the other hand, only 5% of the actual spills came from oil tankers, while 51.8% came from other kinds of vessels. A survey of 9,351 accidental spills that have occurred since 1974 indicates that most spills result from routine operations such as loading cargo, unloading cargo, and taking on fuel oil. 91% of the operational oil spills are small, resulting in less than 7 metric tons per spill. On the other hand, spills resulting from accidents like collisions, groundings, hull failures, and explosions are much larger involving losses of over 700 metric tons.

Crude oil and refined fuel spills from tanker ship accidents have damaged natural ecosystems in Alaska, the Gulf of Mexico, the Galapagos Islands, France and many other places. Smaller spills have already proven to have a great impact on ecosystems, because of the remoteness of the site or the difficulty of an emergency environmental response.

The largest accidental oil spill on record (Persian Gulf, 1991) put 240 million gallons of oil into the ocean near Kuwait and Saudi Arabia when several tankers, port facilities, and storage tanks were destroyed during war operations. In the United States the Exxon Valdez oil tanker ran aground to cause this spill of almost 11 million gallons of crude oil in Alaska, in March 1989. The quantity of oil spilled during accidents has ranged from a few hundred tons to several hundred thousand tons. An oil spill represents an immediate fire hazard. The Kuwaiti oil fires produced air pollution that caused respiratory distress. Recent major oil spill happened when an oil rig, Deepwater Horizon sank in the Gulf of Mexico which killed eleven oil rig workers. The fire resulting from the Lac-Mégantic derailment killed 47 and destroyed half of the town's centre. Spilled oil can also contaminate drinking water supplies. In 2000, springs were contaminated by an oil spill in Clark County, Kentucky. For example, in 2013, two different oil spills contaminated water supplies for 300,000 people in Malaysia, 80,000 people in Coca, Ecuador. Contamination can have an economic impact on tourism and marine resource extraction industries. For example, the Deepwater Horizon oil spill impacted beach tourism and fishing along the Gulf Coast to a great extent. One of the industries most affected by oil spills is fishing. Major oil spills are frequently followed by the immediate suspension of commercial fishing, to prevent the catch and sale of fish that may be contaminated.

Impact of oil spill on Biodiversity

Oil spills affect planktons, larval fish and bottom-dwelling organisms and even seaweed, clams, oysters and mussels. When hundreds of planktons die because of oil, fish don't have enough food to eat, which will cause them to die. If the fish die, there won't be enough food for whales, and they will die, too. So oil spills can smash up the entire food chain in one blow.

Oil penetrates into the structure of the plumage of birds and the fur of mammals, reducing its insulating ability, and making them more vulnerable to temperature fluctuations and much less buoyant in the water. Oil can impair a bird's ability to fly, preventing it from foraging or escaping from predators.. Moreover, ingested oil can be toxic, that can pose a health hazard. Damage to plant life specially saltwater marshes and mangroves is significant.

Animals who rely on scent to find their babies or mothers cannot do that due to the strong scent of the oil. This causes a baby to be rejected and abandoned, to starve and eventually die. Heavily furred marine mammals exposed to oil spills are affected in similar ways. Oil coats the fur of sea otters and seals, reducing its insulating effect, and leading to fluctuations in body temperature and hypothermia. Oil can also blind an animal, leaving it defenceless. There are three kinds of oil-consuming bacteria. (SRB) (Sulfate-reducing bacteria)and acid-producing bacteria are anaerobic, while GAB (general aerobic bacteria) are aerobic. These bacteria occur naturally and act to remove oil from an ecosystem, and their biomass will tend to replace other populations in the food chain. But it takes a long geological time.

Oil spill in Odisha

Impact of oil spill in Chilika lagoon: The lagoon is a highly receptive, productive and important ecosystem due to rich fishery resources and the migratory birds every winter. About 5089 non-motorized boats and 2259 motorized boats are used for fishing which run on petrol, diesel and kerosene as

fuel along with engine oil .Continuous leakage due to poor maintenance of these boats over a period of time poses a great threat to the aquatic organisms.

Oil Spill from MV Black Rose: A major oil spill occurred at a deeper level of the Paradip-Haldia pipeline in the Paradip coast as a Mongolian registered vessel MV Black Rose, sank on 9th September 2009 with 924 tonnes of furnace oil aboard. The oil was being transported to Haldia refinery through the single point mooring system (SPM) when the pipe broke. Under SPM, an undersea pipeline is laid out for 4-5 kms. below the sea level where vessels carrying huge loads of crude oil can anchor and unload the oil without coming inside the port. The site of the spill, is close to the Gahirmatha Marine Sanctuary, home to the endangered Olive Ridley turtles, and the Bitharkanika National Park, which harbours India's second largest mangrove ecosystem and has the largest population of salt-water crocodiles in India. This affected the marine ecosystem to a great extent.

Odisha is planning to have 10 ports in the next decade. Accidents of this kind would devastate the fragile coastal and marine environment, and thousands of fishermen dependent on it. Oil can have subtle and long-lasting negative effect, like seriously impacting fish stocks. Oil can also bio-accumulate up through the food chain as predators (including humans) eat fish that have sub-lethal amounts of oil in their bodies. So, precautionary measures must be taken to prevent such accidents in future.

Conclusion

Coastal areas are usually thickly populated and attract many recreational activities and related facilities that have been developed for fishing, boating, and tourism. Oil spill invades and pollutes these areas and negatively affects human activities which can have devastating and long-term effects on the marine environment, local economy and society. Even though substantial national and international policy improvements on preventing oil spills have been adopted in recent decades, large oil spills are still happening. Accountability for the prevention of oil spills rests upon individuals as well as on governments and industries. Because the sources of oil waste in the ocean are generally due to negligence, rather than accidental, effective prevention of oil spills demands action from all quarters and caution from everyone.

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DEVELOPMENT THROUGH RENEWABLE ENERGY : A CALL OF TODAY'S TIME

Sri Ashutosh Mohanty

Introduction:

In our day to day life, we perform a lot of activities and in this process we use the energy of our body as well as of our surrounding. Besides, energy is regarded as the basic necessity of our life. It provides the ability to do work and numerically energy of a body equals to the amount of work it can do. It is the primary input in any industrial operation such as commerce, transport, telecommunication and household sectors.

Conventional Energy

There are two different forms of energy i.e. conventional energy and non-conventional energy. Conventional energy include the non-renewable resources like fossil fuels which take a longer time i.e. in millions of years for their formation. Ordinarily we use conventional energy as our primary resource in our day to day life, starting from electricity at home to the energy supply in the vehicles.

Disadvantages of Conventional Energy

If we take a look at the other side of these uses several problems caused by the conventional resources can be noticeable.

Pollution

With the gradual increase in the use of coal and petroleum, different types of harmful gases and particulate matters, such as Carbon monoxide, Sulphur dioxide, Lead chlorides, all types of nitrogen oxides and many others are emitted to the earth's atmosphere. As a consequence a lot of health issues like Asthma, miscarriage in pregnant women, different types of lungs and heart diseases arise.

Economic imbalance :

In terms of our coal production index, India has always been consuming more than what it produces and as a result our country has to export coal from other countries at a higher rate. In 2011-2012,our total production of coal was 500 million tonnes and the demand of coal was 600 million tonnes. As per IEA (International Energy Agency) report; by 2020, India will be world's largest coal importer.

In terms of Natural gas production, India is still a growing power like Bolivia. Now, if we take a look at India's import index, then in the financial year 2011-2012, the demand was 212 million tonnes of crude oil, where as our production was only 38.09 million. tonnes, which clearly depicts that, INDIA imported more than 75% of crude oil, at the cost of Rs.7,26,386 crore. Rs.7 lakh crore, which could have taken our country to an unimaginable level, if we had not drained it out of the country and instead used that money for our development.

Non-Conventional energy :

Non-Conventional energy sources are the alternate energy sources or the renewable energy resources, which are abundantly available in nature and get renewed with use. Different types of alternate energy sources are:-

1. ***Solar energy :*** It is one of the major source of renewable energy. The energy given by the sunlight, which falls on earth in one day is 50,000 times more than the total energy consumed by all the countries of world in one year. We can use solar cookers and solar heaters by concentrating all the heat of the sun on the device; since, one-third portion of the sunrays consist of infra-red rays. Solar energy is also used for the production of electricity in Space satellites, Calculators and other devices. Solar energy is a form of renewable energy, which is abundantly available in tropical hot countries like India, where it can be utilized for the production of vast amount of electricity, which will decrease the ultimate pressure on our conventional resources.

2. ***Wind energy :*** Wind is one of the most important sources of renewable energy, which can be very well harnessed in the coastal regions and high mountainous areas, where the flow of wind is perennial and the speed is also high. The cost of the production of wind energy is also very cheap and is free from any pollution causing factors. India with a total coast line of 7516 KM and with high terrains in the north-east regions, is one of the most favorable locations for the production of wind energy. Wind as a power source is available in the form of dispersed energy, which makes its utilization and harnessing very difficult, thereby limiting its utilization.

So, in order to obtain substantial amount of power from wind, we can install several small wind mills and can create farms which will collectively harness a greater amount of energy for our utilization. Different countries of the world (like China, Thailand, USA, Europe) are already harnessing wind energy and parts of the electricity production are being contributed by this energy only.

3. ***Hydroelectricity :*** It is one of the most important source of energy at the present times and even of great importance in future also. Hydroelectricity is not something that has been invented recently but it is in service of mankind for centuries, like other forms of renewable resources. At present 39,788.40 MW of electricity is produced from hydropower stations, which accounts for 17.39% of total electricity production by September 30, 2013. In this, the energy of the naturally flowing water in high rivers is stored behind dams as potential energy and then used to produce electricity.

In the hydroelectric power stations the stored water in the dam are allowed to fall down from top of the dam on a large turbine located at the bottom. The shaft of the turbine is connected to an electric generator. When fast falling water hits the blades of the turbine, the kinetic

energy of the water rotates the coils of the turbine rapidly and thus produces electricity.

At present India is the 7th largest producer of hydroelectricity and according to a survey India has the capacity to strengthen its hydropower stations by increasing the production in many folds from yet to be known sites. Since, the flow of water is perennial and abundantly available; hydroelectricity can play a major role in the alternate energy sector.

4. ***Geothermal energy :*** Geothermal Energy is considered as one of the fastest growing renewable resource in today's world. It is the thermal energy generated from the heat stored in the earth, of which 20% of the heat energy originates from the time of original formation of the planet and the rest 80% of the heat energy is originated from the radioactive decay of the materials.

The geothermal gradient, which is the difference in temperature between the core and its surface drives a continuous conduction of thermal energy in the form of heat from the core to the surface.

Geothermal energy, also called as the fossil nuclear energy has been used since the Paleolithic Times, for bathing and heating purposes but now it is better known for its capacity for electricity generation. Mainly geothermal power is cost effective, reliable, sustainable, environment friendly. But it is only limited to the areas of tectonic plate boundaries. Geothermal power also has the capacity to mitigate global warming if widely deployed in places of fossil fuels. Some countries of the world like ICELAND produce maximum amount of geothermal energy. Some other countries like New Zealand, Japan, Mexico, USA etc. have already established their geothermal power stations, which are filling their energy basket. According to a survey of 2013, around 11,700 MW of geothermal energy is already online throughout the world.

India has also started its first geothermal power plant in Balarampur District of Chhattisgarh in association with NTPC (National Thermal Power Corporation) and CREDA (Chhattisgarh Renewable Energy Development Agency).

5. ***Biomass energy :*** Biomass energy is one of the most Eco-friendly, cheap and pollution free energy.

It can be harnessed in each house, in villages from the organic wastes through biomass Degradation plants. The production of the biomass energy is mainly from the organic wastes like Vegetable pills, cow dung and dried plants. Thus, this will reduce these wastes getting accumulated on the land and production of energy.

6. ***Ocean Thermal Energy :*** Another important renewable but rarely exploited energy resources is Ocean thermal energy. Ocean currents are one of the largest untapped renewable energy resources on this planet. Preliminary surveys show a global potential

of over 4,50,000 MW and as our sea water is 832 times denser than the air, so a 5 knot ocean current can produce as much energy as 350km/ hr. speed wind. As a result, it is not a hazard for the marine environment, unlike the wind turbines which are sited with care, not to affect the flying organisms. From India's point of view this energy can be very much helpful because ocean thermal normally depends on the surface temperature and as our coastline faces warm ocean currents, it will be a better site for the energy production with the appropriate facility development. In the long run, with the aid of technological improvements, we can even power our ships from those currents which will release pressure from our conventional fuel sources.

7. ***Tidal Energy :*** According to Government of India report, the country has a potential of 8,000 MW of tidal energy; which includes 7,000 MW in Gulf of Cambay, 1,200 MW in Gulf of Kutch both in Gujarat, 100 MW in the Gangetic Delta, Sunderbans in West Bengal. India is also all set to develop its first tidal energy plant in Gujarat in collaboration with "Atlantis Resource Corporation".

Efforts by the Government:

Government of India has also created a separate department for the research and development of the renewable resources i.e. "Ministry of Non-Conventional Energy Resources", headed by Mr. Piyush Goyal. The ministry has a mission to bring in Energy security by increasing the share of clean power, energy availability and access to them and by restructuring the energy affordability aspect.

India has made significant advances in several renewable energy sectors, which include solar power, wind power, hydroelectricity and the ministry has been successful in deploying a total of 26,966.96MW capacity of grid based renewable energy and 787.53MW capacity of Off-grid based renewable energy. All the respective state governments have also established their "Energy Development Agencies", which are also working towards the development of renewable resources.

Solutions:

Before few months the national headline was Kundankulam nuclear power plant in Tamilnadu went online to produce electricity and on the other side the northern parts of India including our National Capital are facing heavy energy crisis. If we relate both these issues, then it clearly raises an alarming situation throughout the nation and puts a serious question mark on all our efforts to bring out energy security for now and future. So, from today onwards we need to reduce the energy crisis and maximize the use of alternate energy sources by:-

a) By creating more number of small dams in areas of sufficient water instead of creating big dams.

b) Barrages should be constructed near sea shores to harness tidal energy.

c) Development of solar energy in tropical regions.

d) Biogas plants should be installed in all villages.

e) Users should be imparted knowledge to acquaint them with the consequences of energy crisis.

Conclusion :

Increasing industrialization and unsustainable consumption patterns are enhancing environmental problems due to the depletion of resources and energy. The overuse of renewable resources and the generation of toxic materials during industrial operations create problems to Biodiversity, Environment and Human Health and the use of environmentally sound technologies is considered as the best strategy to provide the paradigm to put our society on the path of sustainability.

So, all of us need to take a vow for the development of renewable resources and maximize its use to carve a beautiful tomorrow. It is also needed to double up our efforts to create an energy pool for the present as well as the future use. We need to conserve energy with its required utilization by which we will not only save money and environment but also can help some other eyes to feel the light of life.

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NEPAL MAY FACE MORE EARTHQUAKES IN FUTURE

Sri Nikunja Bihari Sahu

Geophysicists and other experts had warned for decades that Nepal was riding on the tip of a volcano and vulnerable to a deadly earthquake primarily because of its geology. Nepal is most likely to face larger and more lethal earthquakes in future, even higher than the recent temblor that shook the country on April 25, 2015.

Earthquake experts say that the quake (of April 25) did not release all the pent-up seismic pressure built up in the region near Kathmandu. According to GPS monitoring and geological studies, some 33 to 50 feet more motion of the Tectonic Plate (giant rock slabs that make up the Earth's upper layer) may need to be released in the days to come which may be manifested in catastrophic earthquakes in the region.

Most Powerful Tremor

The recent quake was the most powerful disaster to strike Nepal since the Nepal-Bihar earthquake of 1934 that killed nearly 10,000 people. The earthquake occurred at a depth of approximately 15 km below the Earth's surface (which is considered to be too shallow and therefore more damaging than the quakes that originate deeper inside the ground) with its Epicenter lying approximately 34 km East-South-East of Lamjung in Nepal. Lasting for

about 20 seconds, the earthquake was measured to be of Magnitude 7.8 in the Richter scale.

A second major earthquake occurred on 12 May 2015 with a Magnitude of 7.3 in the Richter scale, 18 km South-East of Kodari. The Epicenter was near the Chinese border between the capital city of Kathmandu and Mt. Everest. It struck at a depth of 18.5 km from the ground. This earthquake occurred along the same fault-line as the previous earthquake (of 25th April) but further to the east. As such, it is considered to be an aftershock of the 25 April quake. Tremors were also felt in the northern parts of India including Bihar, Uttar Pradesh, West Bengal and other North-Indian states. Tremors were felt as far in Chennai located about 2400 kilometers south of the epicenter.

Minutes later, another 6.3 magnitude earthquake hit Nepal with its epicenter in Ramechhap, east of Kathmandu. The earthquake was felt in the neighbouring countries of Bangladesh, China and many other states in India. The impact of these tremors was felt even 1,000 km away in the Indian capital New Delhi where buildings shook and office workers were evacuated.

Devastation

The devastation caused by all these earthquakes was immense and unprecedented. The quake killed more than 8000 people in Nepal mostly due to people being trapped inside collapsing houses. Some casualties have also been reported in the adjoining countries of India, China, and Bangladesh.

It triggered an avalanche on Mt. Everest killing at least 19 people and in Langtang valley where 250 people were reportedly missing. Many heritage monuments were damaged at the World Heritage sites of UNESCO in the Kathmandu Valley including the Durbar Squares of Kathmandu, Patan and Bhaktapur. Nepal Government had declared three days of State mourning after the quake. The country was battered by continued aftershocks in every 15 to 20 minutes interval with one shock reaching a Magnitude as high as 6.7 in the Richter scale. At least 117 people died and about 2,500 people were injured in Nepal as a result of these aftershocks. Seventeen people also died in India. The catastrophe has indeed left everybody scared and scarred in the region.

The Cause

The terrible earthquake was the latest result of an ongoing collision between the two giant tectonic plates of our planet Earth. According to the US Geological Survey, the temblor was caused by a sudden thrust, or release of built-up stress, along the well-known Fault line where the Indian Plate carrying India is slowly diving underneath the Eurasian Plate carrying much of Europe and Asia.

Between 55 million and 40 million years ago, the Northern edge of what is now India

began to slam into the giant slab of Earth's crust that today carries Nepal and Tibet. India bulled its way under Nepal those many millions of years ago shoving the northern land skyward. That move began to create the towering Himalayan folding mountains. The collision is still now going on as India continues to move several centimeters north every year. This has created an unstable fissure in the planet's crust known as the Himalayan Frontal Thrust Fault. This boundary zone between these two plates is highly unstable from geological point of view and continues to release enormous energy that created the recent earthquake and is expected to result more devastating effects in future.

Reconstruction Measures

This is a very catastrophic event for a very poor nation like Nepal as the cost of the reconstruction over the next few years will be immense. Rebuilding costs could easily exceed an estimated 5 billion US Dollar which would be about 20% of Nepal's Gross Domestic Product. Massive international disaster relief and rescue efforts will be needed urgently, as well as large scale global financial and technical support for long-term reconstruction and rehabilitation of the country's economy.

Preventive Measures

On average, one 8 Magnitude quake strikes somewhere around the globe every year and some 10,000 people die in world-wide earthquakes annually. Collapsing buildings claim by far the majority of lives; but the destruction is often complicated by other calamities like mud slides, fires, floods or tsunamis. Smaller temblor after-shocks that usually occur in the days following a large earthquake can hinder post earthquake rescue efforts and cause further death and destruction. Loss of life can be avoided through efficient emergency planning, sensitization measures and earthquake prone construction design of buildings that sway rather than break under the stress of the tremor.

Unfortunately, like other natural calamities of floods and cyclones, occurrence of earthquakes cannot be predicted, and hence, early warning cannot be issued. The only clue to foretell the catastrophe is to observe the anomalies in the behavior of animals which the Chinese have greatly improved over the years. Certain animals like elephants are said to be capable of hearing the low pitched rumbling sound of the motion of the lithosphere plates and migrate to safer places to avoid the imminent danger. But this method of relying on the animal's behavior has its own limitations and is not very accurate. Under this limitation of the present day technology in forecasting the earthquake, the only option remains at hand is the greater human preparedness and the efficient relief and rescue operation to minimize the loss of life and property.

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ARTHRITIS -A DISEASE OF HIGH MORBIDITY

(On the eve of World Arthritis Day-2015)

Dr. Choudhury Satyabrata Nanda

"It is in your hands, take action"--the theme of World Arthritis Day on 12 October 2015 is to create awareness among people globally and to encourage people with rheumatic and musculoskeletal diseases (RMDs) to make a quality of life of difference (Fig.1).

What is Arthritis ?

There are a varieties of tissues found in human body. One such tissue is called connective tissue. In mother's womb this tissue differentiates in to specialized tissues required for musculoskeletal function, such as muscles, tendons, ligaments, cartilages and bone. Ligaments are the bands of tough flexible bands holding bones in a joint. Tendon is an inelastic cord of tissue attaching a muscle to a bone. Cartilages are soft and firm bone lies in vicinity of articular surfaces of bones. As we know bones are joined to each other at joints. Muscles, cartilages, tendons, ligaments lie in intimate contact to a joint (Fig.2). Arthritis denotes to a variety of inflammation involving joint, tissues around joints and connective tissues. The symptoms (what a patient complain like pain, stiffness etc.) found in both diseases of arthritis and musculoskeletal diseases are similar making the person incapacitated and becomes difficult to bring a distinction. This is the reason for which rheumatic (a common form of arthritis) and musculoskeletal diseases are taken as a single entity (RMD). There are over more than hundreds of arthritis and musculoskeletal diseases encountered in medical science. The most common form of arthritis is osteoarthritis (a degenerative form of arthritis) occurring due to trauma, infection and aging process. Other forms are rheumatoid arthritis, gout, psoriatic, septic and autoimmune variety etc. (Fig.3).

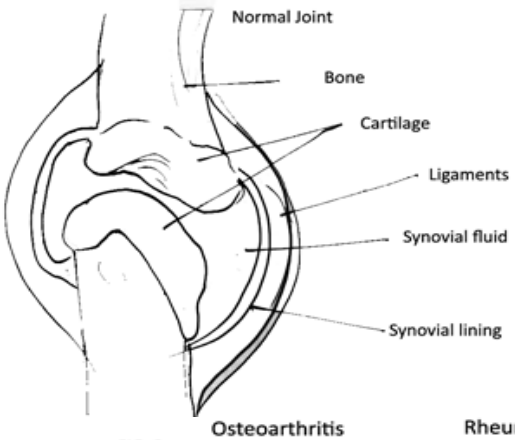

FIG: 2

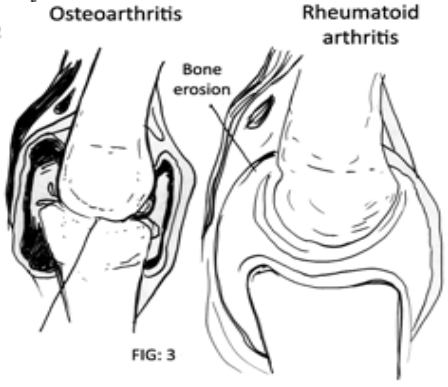

FIG: 3

The European league against rheumatism (EULAR) is highly active in this field taking a leading role involving all groups of people in promoting international activities and present new and innovative approaches facilitating the life of people with rheumatic and musculoskeletal diseases a quality one. (Fig.4) Since the action plan and implementation is a time consuming one a common theme is assigned for 2015 and 2016.

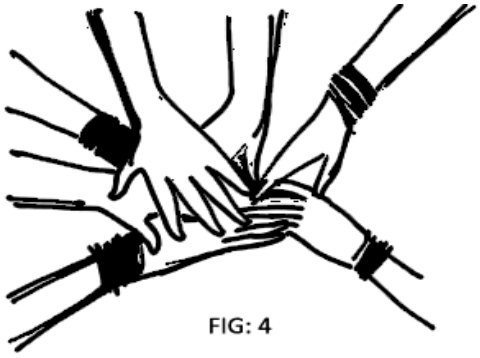

FIG: 4

Incidence of Arthritis

Rheumatic and musculoskeletal diseases affect people of all age groups and ethnic groups. Their frequency increases with age. In India 15% people representing over 180 million suffer from arthritis. In United States an estimated 52.5 million adults suffer from arthritis in the form of rheumatoid, gout, fibromyalgia, and lupus which amounts to 22.7% of the population. A worldwide recent study indicates a higher prevalence of arthritis in European countries. In United Kingdom 40% people suffer from some form of arthritis and 20 million people experience some rheumatic pain each year. Arthritis has higher age prevalence in women (23.9%) than men (18.6%) and increases with age in every age group. In a rough estimation 60% of all people with arthritis are women. However gout has a higher prevalence rate among males. An estimated 294,000 children under the age of 18 have some form of arthritis or rheumatic condition and in US it represents approximately 1 in every 250 children. Specific genes are associated with certain varieties of arthritis like rheumatoid arthritis, systemic lupus erythematosus and ankylosing spondylitis.

Forms of Arthritis

Arthritis can be grouped in to two types, such as primary and secondary. There are forms of arthritis where joint pain is the dominant feature and named as primary and in some other forms arthritis joint pain is secondary to the main disease. To name few they are as follows:

Primary : Osteoarthritis, Rheumatoid arthritis, Gout arthritis, Septic arthritis, Ankylosing spondylitis etc.

Secondary : Psoriasis, Hepatitis, Inflammatory bowel disease, Sarcoidosis, Lyme disease.

Impact of Arthritis

Arthritis has a significant impact on individual impairing the ability to perform routine works and discharging their responsibility towards family and society. This in return affects the physical, emotional, mental and spiritual health of a person on his productive year of life costing a heavy burden to society. In a survey conducted by the global society

reported that 43.2% (22.7 million) of adults report limitations in their usual activities and 40% complain of severe limitation of routine work. It limits so much that bending, stooping etc. are almost impossible.

Cause of Arthritis

There is not a single cause to attribute for arthritis. Some of the potential risk factors resulting in arthritis are as follows:

1. Overweight and obesity can contribute to both the onset and progression of osteoarthritis of knee.
2. Injury to a joint brings degenerative changes in cartilage and synovial membrane of the joint resulting in arthritis (Fig.5).
3. Infection does play a role in bringing down anatomical and physiological changes in a joint as in septic arthritis and Lyme disease.
4. Error in metabolism poses a serious threat to joints as in gout and pseudo gout.
5. Immune system overactive plays a significant role in bringing arthritis. This is seen classically in cases of rheumatoid arthritis and systemic lupus erythematosus.
6. Inheritance is an unmodifiable cause for osteoarthritis.

In most cases of arthritis the cause is a combination of many factors playing together. Genetic makeup make a person more susceptible to certain type of arthritis but physically demanding occupation, smoking, infection and previous injury triggers the occurrence and progression of arthritis. Recent study has linked the use of prolonged antibiotics with that of arthritis in children.

Signs and Symptoms of arthritis

Since arthritis is a chronic disease the symptoms have remissions and exacerbations and may persist for prolonged periods. These can come suddenly or has an insidious onset.

1. Pain becomes an early symptom of arthritis drawing the attention of patient and doctor. It is either temporary or becomes permanent subsequently. In cases it is either localized to a single or felt in multiple joints.
2. Swelling becomes a devastating complain where the skin overlying the joint show signs of inflammation like redness, swelling and a warmth feeling of the part.
3. Limitation of movement is subsequently marked. The physiological functions of a joint are arrested in order to accommodate the pathological condition of the joint called deformity (Fig.5).

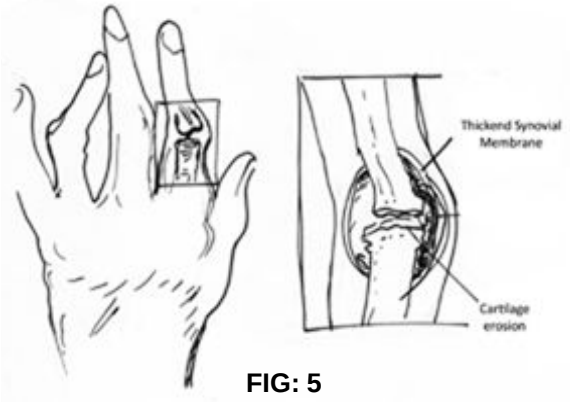

FIG: 5

4. Stiffness is a typical symptom of arthritis which is invariably marked during morning hours after waking from bed or after a prolonged sitting.

All these symptoms are either present in single or in combination.

Evaluation of arthritis

In evaluating cases of arthritis few things are taken in to consideration like symptoms (present and past), physical findings, imaging and laboratory studies. Laboratory tests and imaging are helpful in confirming a clinical diagnosis and in assessing the activity and progression of the disease.

1. Erythrocyte sedimentation rate, plasma viscosity and acute- phase reactants: In active inflammations of joints liver synthesizes c-reactive protein (CRP), serum amyloid A (SAA) and some other acute phase proteins and there is a fall of albumin concentration. These changes are reflected in erythrocyte sedimentation rate and plasma viscosity.
2. Biochemical tests : Serum aldolase and creatinine phosphokinase levels are raised on inflammation of muscles. Serum uric acid elevation is a specific marker of gout arthritis.
3. Serological tests : In certain forms of arthritis there is formation of immunoglobulins in patient serum as rheumatoid factor which is specific for rheumatoid arthritis. In systemic lupus erythematosus form of arthritis there is formation of antinuclear antibodies in serum detected by indirect immunofluorescence. Detection of HLA B27 antigen is specific for rheumatoid arthritis.
4. Synovial fluid analysis : Analysis of synovial fluid in certain forms of arthritis establishes a rapid diagnosis as in cases of joint infections and crystal arthropathies. Presence of blood indicates hemophilia or traumatic arthritis.
5. Imaging: (a) Radiographs are frequently used as a diagnostic aid in patients with arthritis and very helpful to watch the progression of osteoarthritis and inflammatory joint diseases. In some patients radiographs show diagnosis of diseases even in the absence of symptoms and signs. Other tests like (b) Computed tomography and (c) magnetic resonance imaging are used for detail analysis of articular and peri articular pathology of the joints.
6. Tissue biopsies: These are seldom used but in tubercular arthritis the synovial biopsy confirms the diagnosis.
7. Arthroscopy: This is not a routine procedure but in cases of trauma the extent of damage of meniscus can be ascertained and also the degree of involvement in osteoarthritis.

Managing arthritis

The different modalities of managing arthritis rest on relieving pain, reducing stiffness and restoring the loss of functions induced by

the disease process thereby improving the quality of life. In this regard the American college of rheumatology has laid down certain principles which are accepted globally.

1. Medication: For the purpose of medication the arthritis is differentiated whether it is non-inflammatory or inflammatory type. In non-inflammatory variety like osteoarthritis the modalities of treatment lies on analgesics (acetaminophen, tramadol, oxycodone etc.), weight loss and physical activities etc. However in inflammatory type to the above measure anti-inflammatory medication like nonsteroidal anti-inflammatory drugs (ibuprofen, naproxen), disease modifying anti-rheumatic drugs (methotrxate, hydroxychloroquine), corticosteroids and a new class of biologic agents (etanercept, infliximab) are added.
2. Self-management: There are few habits need to be practiced like; to be organized, managing pain and fatigue, staying active, balancing activity with rest, eating a healthy balanced diet, improving sleep, and taking care of the joint.
3. Physical therapies: This helps in reducing stiffness of joint making patient more comfortable. (a) These include warm water therapy where exercise is done in a warm water pool and the water supports weight and puts minimal pressure on joints. (b) In support of ice, wax or hot packs along with massage physical exercise done which has got an immense value to the treatment. (c) Occupational therapy helps on managing the day to day task with the help of specialized aids and equipment's and protecting the joint.
4. Physical activity: With a continual of exercise, pain and joint stiffness are minimized. Some of the exercises like walking, swimming and riding a bike are joint friendly.

Arthritis is a chronic inflammation of joints resulting mild to disabling pain, stiffness of joints and deformity. Earlier days this confined people to wheel chair with a severe physical and emotional compromise. With recent advances in medical science and awareness on the disease process it is no more a disease of morbidity. In awareness programme sufferers are motivated to participate in their own treatment and enhancing self-care there by continue a productive life.

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CASHEW APPLES FOR NUTRITION AND HEALTH

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Cashew (Anacardium occidental L.) is now considered as a major cash crop in many parts of the world including India, which is the second largest producer with an annual production of more than 6 lakh metric tons (MT) of nuts (Food and Agricultural Organization Report 2010). The other important producers are Nigeria (6.5 lakh MT), Ivory Coast (3.8 lakh MT), Vietnam (2.9 lakh MT), Indonesia (1.45 lakh MT), Philippines (1.34 lakh MT), Brazil (1.04 lakh MT), Guinea Bissau (91 thousand MT), Tanzania (80 thousand MT) and Benin (69.7 thousand MT). However, it is a native of Brazil. The European explorers were responsible in spreading it to other countries, particularly, to a vast tropical region of Asia and Africa including the above countries. It was introduced in India (in Goa) by the Portuguese. At present, 60 varieties of cashew are cultivated in our country in several states like Andhra Pradesh, Telengana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Goa, Odisha, Tamil Nadu and West Bengal.

The cashew fruit has two distinct parts: the nut and the apple. After the harvest these are separated. For every kg of yield of nuts, 5 to 6 kgs of apples are produced. While the formers are dehusked, processed and marketed, the laters are by and large treated as agricultural waste and those are not sold commercially. It is because the cashew apple is rich in tannin (about 35%) that gives it an unpleasant taste. But those are very nutritive (Table-1) and if properly processed can play a role in diminishing many types of malnutrition, particularly, arising from the deficiencies of minerals and vitamins. Beside, those are low in fat and carbohydrates, while containing useful quantities of dietary fibres. Therefore, the obesed people as well as diabetics can safely consume those.

Table 1: Nutritive composition of cashew apples (100g)

Constituent	Quantity
Moisture	84.4 - 88.7 g
Protein	1.1 - 0.2 g
Fat	0.1 - 0.5 g
Carbohydrates	9.08 - 11.1 g
Dietary Fibres	1 - 3.2 g
Ash	0.19 - 0.34 g
Calcium	5.4 - 11.1 mg
Phosphorous	6.1 - 21.4 mg
Iron	0.71 - 2 mg
Potassium	124 mg
Carotene	0.03 - 0.742 mg
Thiamine	0.023 - 0.03 mg
Riboflavin	0.013 - 0.5 mg
Niacin	0.13 - 0.539 mg
Vitamin C (Ascorbic acid)	146.6 - 372.0 mg

Realizing these facts, in recent days many of the major cashew producing countries are developing processes to move various cashew apple recipes. For example, in Costa Rica the locals are preparing candy cashew apples from the sliced sundried fruits (pseudo fruits). Similarly, in Brazil, Nigeria, Benin and Senegal, the juice extracted from those is cooked to improve the flavour and to reduce the astrigency, which is then treated with sugar, malic acid and other ingredients to prepare different types of drinks. However, all these recipes are prepared mostly at houses or in cottage industries by the locals for their domestic use and have not proved to be commercially attractive. Therefore, in spite of those the major part of the cashew apples are wasted, rather thrown away by the farmers.

Cashew Apples

Under such circumstances, the recent announcement of the soft drink giant Pepsico India to their extract in mixed fruit juice drinks to replace costly fruits like apple, grape, pineapple and banana is really a refreshing news. It may turn those so called agricultural wastes into industrial raw materials, which can be beneficial not only to the farmers and the industrialist but also to the common consumers, who will get the healthy soft drink at a more reasonable cost. The company has planned to start the production and marketing in India from 2015 under the Tropicana label and eventually spread it to the international market. Since it is a good source of iron, phosphorous, calcium and vitamin C, it can also be promoted as a health drink.

Fresh Cashew Apples Juice

Bottled Cashew Apples Juice

At present, the most important use of cashew apples has been to prepare alcoholic drinks. In Goa, these are mashed and the extracted juice is fermented and distilled to prepare feni or fenny, which contains about 40-42 % alcohol. Similarly, in other places

various other kinds of alcoholic drinks are prepared. Those include gongs in Mtwana and Tanzania, aqua ardente (burning water) in Mozambique and percival in West Indies and have alcoholic contents between 35 % and 45 %. Therefore, scientists are contemplating the idea of utilizing cashew apple juice to prepare biofuel. A paper explaining the details of the procedure was published in the Journal of Applied Biochemistry and Biotechnology (2008). However, very little has been done so far to try the technology on large scale commercial basis.

Cashew apples are also traditionally used as medicine by a number of tribes engaged in cashew cultivation. As for example in Amazon and some African countries they use those to maintain stomach health and to combat fever and diarrhoea. They also use the juice to treat wart, rejuvenate skin, help hair growth and fight baldness, prevent tooth decay and even to fight premature ageing. These traditional knowledge should be scientifically investigated and established. In fact, some scientists have already taken up such projects. As a result, it has been revealed that cashew apple juice has moderate anti-tumor activity against breast cancer and cervical cancer and anti-microbial and anti-bacterial properties against several strains of microorganisms. Similarly, other studies suggest it to be an inexpensive source of beneficial probiotics, helpful to burn fats and enhancer of athletic performances. However, these studies should be more extensive and conclusive so that this underutilized resource can be turned into an useful one.

One of the major drawbacks of cashew apples is that these are highly perishable and rot in 2-3 days after plucking creating problem for preservation. Therefore, it is necessary to make provisions for extracting the juice immediately after the harvest and to preserve it in freezing conditions near the farming sites, before transporting it to the industries. However, the problem has its benefits too, for it can provide the local people with work at their door step and to the industry with cheap labour. Moreover, transporting juice will be convenient and cheaper than transporting the apples. Again the residues can be used as compost.

Cashew plantation flourishes in tropical climates and can grow in saline soil needing little fertilizers, irrigation and care. When the Portuguese traders (in the 16th century) introduced it in Mozambique and in Coastal India as a soil retainer to stop erosion, it grew rapidly to form extensive forests in these localities and the nearby islands. Therefore, it should be planted all along the coast of our country to expand the small scale cashew industries that can process the nuts as well as the apples. Besides, the plantations can also serve as a shield against the cyclones, which have become more frequently these days.

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NON DRUG THERAPY - HEALTH FOR ALL

Prof (Dr.) Chaturbhuja Bhuyan

Introduction

The life of man is a life of wants and needs and therefore desires borne not only in his physical but also in his mental and spiritual life process. Thus now-a-days sophisticated and modernized living is making the present generation more complex day by day. The complexities of life is creating severe stress and strain in the mind of human being, consequently accumulating in the specifically nervous system, as a result, a number of psychosomatic disorders like, heart diseases, hypertension lungs diseases, bronchial asthma, different arthritis, suffering from many common to severe diseases like diabetes, common cold, ulceration etc are borne.

Object

Hence to treat, and restore and also health to healthy is a basic need and right of the human being. It is definite; drugs play an important role in treating, protecting, restoring and maintaining health in day to day life. In this regard we may cite drugs are essential. But it is observed that an explosive growth in the number of drugs and their formulations have been developed which are not available. All the drugs are not beneficial and some of them are definitely harmful to health. The aim of treatment is not to create any disease while treating to a certain disease, but in this respect NDT is completely free from any type of adverse effect and no disease is born by using this therapy. It can be practiced and utilized by one and all irrespective of sex, caste, creed, age and religion. Of course it is the Indian science of cultural heritage. Culture is a means to an end, the end being the happiness and all around prosperity of one's own country and of humanity. Culture consists in a harmonious and balanced cultivation of all the faculties in man. Culture and civilization are two inseparable aspects of the life style of a community, country or nation. Culture is an external way of life. Culture is a flower, while civilization is like the fragrance of the flower. Hence it is understandable from this statement as to how and what valuable therapy it is for the sake of holistic health for all.

Essential Drug

Now let us know how to decide on the drugs which are essential. The concept of essential drugs according to the version of the use of essential drugs by WHO 1990 that "essential drugs are those that satisfy the health care needs of the majority of the population they should therefore be available at all times in adequate amounts and in the appropriate dosage forms". In this connection it is emphased "all essential drugs may be rational but all rational drugs are not essential".

Importance of NDT

At present the time has come to think on the importance of drug therapy in comparison to non-drug therapy. Can we provide drugs to all corners of the people in real needy time? Certainly it may not be possible. Therefore the non-drugs therapy can play vital role to protect, maintain, and restore the health and also to treat the disease. In addition, this therapy can add health, vigor, energy and prevention of aging in life process. Most important, is that the non-drug therapy can reach any extent of the globe, if the process of extension and circulation are done properly by us. Under this ND therapy, the following factors are included. Generally, the balanced diet, normal behavior, daily, and seasonal regimen as per guidelines are definitely to be maintained. And many other adequate useful therapies are included. They are as follows:

Type of Therapies

Yoga Therapy, Psycho Therapy, Physio Therapy, Naturopathy, Mud Therapy, Water Therapy, Spell Therapy, Photo Therapy, Color Therapy, Acupuncture, Acupressure, Immune Therapy, PCA Therapy, Pranic Therapy, Magnet Therapy, Rejuvenate Therapy, Virility Therapy, Japa Therapy, Traditional Therapy, Sun Therapy, Flower Therapy etc.

Yoga Therapy

Among all these therapies, yoga therapy is the best, which can guide life to remain free from ROGA (diseases) and BHOGA (Worldly pleasures). It is now a universal agreement that the health of an individual is a basic need for all developing society. To respond this vital issue, Yoga therapy is the best non-drug therapy which can address all the health problems anywhere in the world.

In this respect, it may be highlighted regarding Yoga that many researchers in the medical field are very much interested to avoid the adverse effects of drugs and advise to adopt Yoga therapy.

Preamble of Yoga

Since time immemorial there are a number of descriptions of Yoga in Veda, Ayurveda, Purans and Upanishadas. The simplest meaning of Yoga is union. The yoga embodies unity of body mind and soul. The practice of Yoga brings unity, amity, love and harmony within and without. It can be stated that Asans, Pranayams etc. are the different aspects of Yoga. These are concerned with body and mind. Yoga is a panacea for all kinds of pain.

Originally there are two distinct types of Yoga practices. One of them is meant for the monk where as another form of practice of Yoga is advised for the actively involved persons with family and worldly affairs.

Science of Yoga

Now the present problematic world needs to revitalize our own Indian scientific heritage i.e. Yoga .To remain healthy, practice of yoga is essential. All human beings, irrespective of casts creed and religion and

seekers of divine life should adopt this system. The human body consists of billions, and billions of smaller functional units called cell. Every living cell has a certain life span in terms of its metabolic effect. Any internal damage to cell is prevented by maintaining homeostatic condition and at the same time the metabolic activities of these cells are maintained at a slightly lower level. It is possible to increase their life span. So if the metabolic activity of cells could be decreased, then the cell can maintain homeostatic conditions properly. As a result immunological process and other defence mechanism will be able to make it more active for longer period. Next the functioning of almost every structure in the body is dependent as the optimum functions of the C.N.S. The Central Nervous system (C.N.S.) is the most important structure required for the maintenance of the normal homeostatic conditions in the body. The autonomic nervous system, a part of peripheral nervous system mainly operates this function. After all, the human mind has its basis on human nervous system. In this regard the physiological explanation of the practice of different types of yoga can be ascertained, which in fact impact and influence the body, i.e. (i)Yogic exercises improve physical functioning of some peripheral system of the body. (ii) It can bring about equilibrium in the different functions of the body. (iii) It is possible even to condition the higher nervous regions. (iv) The regular practice of Yoga also brings a state of profound physiological rest accompanied by mental alertness and also helps in reducing oxygen consumption, carbon dioxide elimination and arterial lactate concentration, that decrease heart rate and respiration.

Perhaps the most basic aspect of any system of medical science is to provide rest which is the perfect antidote to stress and strain, because rest allows the body towards cure from any kind of disease. The perfect and sound rest can be obtained through this non drug therapy "Yoga Practice". This Yoga practice contributes to achieve of perfect rest through the nervous system. As a result nervous system becomes more flexible and stable. Hence, it is worthwhile to emphasize that Yoga is essential for everybody to solve the burning health problems of this modern society.

Holistic health Steps

Yoga is the model of holistic health. The overall aim is to attain the physical, mental and spiritual health. There are four types of Yoga. They are Raja Yoga, Jnana Yoga, Bhakti Yoga and Karm Yoga. Besides, there are Japa yoga, Sankhya yoga, Mantra yoga Tantra yoga, Shabda yoga, Dhyana yoga etc. Among these Raj Yoga is said to be the best means to attain the goal of life. It is the royal road to God consciousness, by which we can attain our positive health by practicing this best non drug therapy. This Raj Yoga is systematized and divided into eight steps. These are called:- Yam, Niyam, Asana, Pranayam, Pratyahar, Dharana, Dhyan and Samadhi.

Steps of Yoga

A Line of appreciation regarding the Yoga by Patanjali may be cited that these are all means to attain transcendental knowledge. Its first step Yama (Restraint) includes non-killing, truthfulness, non-stealing, continence and non-receiving of gifts. Niyam comprises of cleanliness, contentment, mortification, study and self surrender to God. Then comes Asana or sitting posture. There are a number of sitting postures for betterment of physical health. Pranayam (The science of breathing) (exercise in the sitting postures) makes the vital air or Pranavayu get controlled over breath. Pratyahar is to make the mind introspective, which really helps mental health. Dharana means concentration. It is the process of concentration of different modifications of the mind on to a point. The next step is, Dhyana or meditation. In this step the body, mind and soul remain in one state which leads to a potent stage power. The last step is Samadhi or super conscious state of the mind. This state is known as self realization and God consciousness.

Yogasanas

There are number of Asanas. Out of them some common Yogasanas are there, for the positive health of individuals which can be, practiced, daily, Viz, Sukhasan, Padmasan, Bhadrasan, Salavasan, Bajrasan, Pashimottansan, Maschyasan, Sarvangasan, Birasan, Janusirasan, Sabasan, Halasan, Utanapadasana, Mukta pavanasan, Makarasan etc According to disease Asanas are also prescribed with its time, place, duration, procedure of practice under some educated, trained skilled Yoga therapist/teacher. Generally for health it can be practiced following the guidelines under a master trainer till there is perfection. Asans promote the exercise. In addition, Pranayams can be practiced. All these build sound body and mind for higher thinking and peace of mind.

TIPS for Treatment

By exercising these Asans many diseases can also be treated i.e. - Any sort of arthritis (OSTEO ARTHRITIS, RHEUMATIC ARTHITIS, Spondylitis, Sciatica), High blood pressure, Diabetes, Heart disorders, Sleeplessness (Insomnia), Obesity, enhancement of memory power, concentration, and many other diseases. Research is going on in different institutions in India and abroad, not only in the treatment sectors but also to establish peace in the global society. The political and social acceptance with growing patronization and support shall really uplift this NDT and popularize in the entire globe. The present steps taken by the popular government are definitely praiseworthy.

Tips for Physician

In fact all our knowledge depends upon comparison of study and result. However, if we have a standard/Knowledge of disease, treatment and health, then we can compare with that standard. But so long as we have

not made a standard, it is very difficult to know anything better and naturally we consider our present status of treatment and health as the best. There is nothing that can be higher or greater than this. Hence, it may be concluded that an intelligent person treats the world as his master. A clinician should open his mind to learn and receive the knowledge from all other medical sources/sciences, that medical science can be developed and be beneficial to all.

Tips for Public Appeal

It is a known fact that "Sound mind makes sound body". The body and mind reflect simultaneously concentration and balanced play in each and every sphere. Stress and strain in mind play vital role to invite diseases. So in order to avoid these factors, Yoga is the real science of health which is open to all and can serve all. All can practice Yoga. It can bring all sorts of peace and happiness without any cost. It can add to life keeping it free from diseases and worry. Under the guidance and instructions of this therapy, the aging process possibly can be prevented. An individual can remain happy throughout the life. It is an appeal to one and all; to adopt this common therapy to strengthen our body and mind to build a healthy human society in the entire world.

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QUIZ : DEER

(PART - I)

Dr Prafulla Kumar Mohanty

1. The deer belongs to the family

a) Bovidae b) Cervidae
c) Giraffidae d) Antilocapridae

2. Deer are commonly known as

a) arboreal mammals
b) odd toed mammals
c) even toed mammals
d) horned mammals.

3. The state animal of Odisha is

a) Sambar b) Sika
c) Pudu d) Barasingha

4. The state animal of Punjab, Hariyana and Andhra Pradesh is

a) black buck b) water deer
c) Pudu d) sika deer

5. The state animal of Uttrakhand is

a) musk deer b) marsh deer
c) hog deer d) pampas deer

6. The state animal of Uttar Pradesh and Madhya Pradesh is

a) swamp deer b) roe deer
c) chital deer d) spotted deer

7. Which of the following animal is not a true deer that appears to be a deer and recognized as the stae animal of Rajastan?

a) chinkara b) moose
c) sika d) red deer

8. Which deer is only capable of feeding under water?

a) moose b) roe deer
c) fallow deer d) mule deer

9. Which of the following animal possesses a scent gland in its navel region ?

a) fallow deer b) march deer
c) musk deer d) tufted deer

10. Which of the following is not a true deer?

a) musk deer b) mouse deer
c) elk d) both (a) and (b)

11. The deer characterized by palmate antler is

a) moose b) south andean deer
c) white lipped deer d) mule deer

12. Which deer possesses a pair of long movable canine?

a) blacktailed deer b) marsh deer
c) chital d) water deer

13. Which deer possesses the lowest diploid number of chromosomes?

a) Indian muntjac b) sambar
c) moose d) pudu

14. The deer characterized by antlers in both the sexes is

a) reindeer b) mule deer
c) hog deer d) water deer

15. Which of the following deer does not have antlers?

a) wate rdeer b) reindeer
c) mouse deer d) marsh deer

16. The life span of the deer is

a) 12-20 years b) 10-15 years
c) 10-20 years d) 5-10 years

17. The breeding period of the deer is called as

a) rut b) doe
c) stag d) hind

18. Gestation period of deer is

a) 100-150 days b) 200-250 days
c) 200-240 days d) 200-300 days

19. The horns of the deer are truly

a) horns
b) antlers
c) both horns and antlers
d) none of these

20. The antlers of deer are branched and horns of antelopes are not branched.

a) Always true b) Always false
c) Sometimes true d) Sometimes false

ANSWER

1. (b) 2. (c) 3. (a) 4. (a) 5. (a)
6. (a) 7. (a) 8. (a) 9. (c) 10. (d)
11. (a) 12. (d) 13. (a) 14. (a) 15. (a)
16. (a) 17. (a) 18. (c) 19. (b) 20. (a)

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