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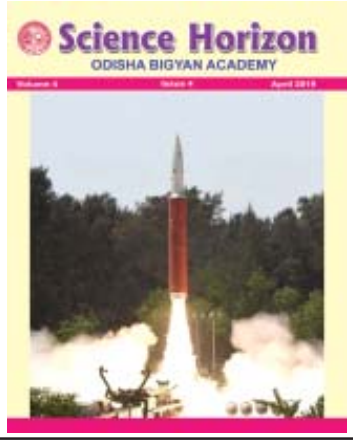

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The Cover Page depicts : **India's Anti-Satellite Test** *Cover Design :* ***Kalakar Sahoo***

EDITORIAL
INTERNET OF THINGS

We are now passing through the age of information technology. Computers and internet are the main components of this technology. Our lives have become more fast due to this. Another component has been added to this system recently. This is the Internet of Things (IoT) which along with computers and smart phones connects things around us. IoT consists of a group of devices or systems (including machines, houses, vehicles, smart phones, home appliances etc. interconnected through internet. It enables the devices or system to collect data from the environment and exchange the same among them. It is a simple concept that enables devices to communicate intelligently through the internet and turn the devices into smart devices. In fact, all the systems related to our society or our lives can be connected to IoT. Sensors and actuators embedded in physical objects are linked through wired and wireless networks, after using the same Internet Protocol (IP) that connects the internet.

IoT is defined into three categories such as (a) people to people, (b) people to machine/ things and (c) things/machine to things/machine. The goal of IoT is to enable things/people to be connected any time, any place, with anything and anyone using internet.

One example of IOT is smart classroom. This is called smart, because it uses IoT. In a smart class room there are several devices such as lights, projector, digital TV, laptop, thermostat, nest cam etc. which are connected through network or through internet. In normal classrooms, these are not connected. Smart classroom has many advantages. For example, in a smart class room, the laptop of each student is connected to a network to which the projector is also connected. So in a large classroom, the information displayed on the board by the teacher is seen by each student in his laptop. If the room is larger and students from last benches can not see the black board, it does not matter.

Let us take another example of IoT concerning with the health care of people. A person is wearing a health tracking wristband (a type of bio-sensor which is a product of IoT concept. This band is continuously monitoring and gathering information about his health condition and transferring it to a network where it is stored. From that network the information is transferred to the person's smart mobile phone and if anything is serious, it can give an alarm. The information from the same network can also be transferred to the person's personal physician or to a hospital to which he is regularly visiting for health check-up. In case of emergency such as heart-attack, stroke, asthma-attack etc., an ambulance with the related medical facilities can be sent to the person's residence by the hospital authority. This IoT facility can save a person's life. Remote health monitoring is being done using IoT concept and it is particularly important for old and lonely persons.

Apart from above two examples, there are now many applications of IoT available and the number is increasing rapidly. Some fields where IoT concept has been successfully implemented

are health/medical, traffic monitoring security, transport, logistic and daily life. According to a recent report, the number of IoT devices installed has reached 5.0 billion world wide and it is predicted that it may increase about five-fold by 2020. Potential applications of IoT are numerous and diverse.

The term Internent of things is 20 years old. But the actual idea of connected devices had been around before, at least since the 70s. Then it was called "embedded internet" or "pervasive computing". But the actual term IoT was coined by the American Computer Engineer Kevin Ashtan in 1999. Of course, before that some kind of IoT was used in industry. For example, the term "machine to machine" (M2M) has been in use for more than a decade and is well-known in telecom sector. Initially, in telecom M2M was a concept of linking one machine to another. But today the technology has been effective for transmission of data to a much wider range of devices through the internet. In industry, there was also another primitive type of IoT which was called machine-human interference. It is connection between machine and human, which helped the operation of big plants. The control was semi-automotive and now with the help of IoT it is fully automotive.

Recently, we are hearing the term 'Smart City' and our capital city Bhubaneswar is tagged with this. Smart city means, every work will be done here quickly and automatically without any disadvantages to the citizens. It includes traffic management, electricity distribution, water distribution, waste management, street light, security, transportation and environmental monitoring. Smart city concept promises to reduce the difficulties and pains of the people living in the city.

Another IoT concept hotly debated in electricity distribution sector is smart grid. It collects and uses data about the behaviour of electricity suppliers and consumers in an automated fashion to improve the efficiency, reliability, quality and economics of electricity.

Smart home is the application of IoT, where it describes the connectivity of different devices in home. It includes thermostats, smoke detectors, light bulbs, appliances, entertainment systems, windows, door locks and much more. For example, the air conditioner will start or stop depending on the temperature of the environment, which is recorded by a thermometer. It may happen also that when the owner of the house comes, the door is automatically unlocked and opened and when he enters the house it is again closed and locked. If any attempt of burglary takes place at home, the CCTV system can send an alarm to the owner, wherever he may be or to the nearest police station through the internet. Refrigerator with LCD screen will tell what is inside, food that is about to expire, ingredients we need to buy etc.

Now we are hearing about driverless car and pilotless aircraft (drone). These operate on the concept of IoT. Similar concept is used in guided missiles.

IoT is a new revolution of the internet. It makes different people/devices smart and intelligent through the use of internet. It is not a single technology, but a mixture of different hardware and software technology. Lot of researches are going on IoT for more precision of the technology and wider applications.

Er. Mayadhar Swain
Editor

ISRO'S SPACE AMBITIONS

Nikunja Bihari Sahu

Recent Adventures of ISRO

After shooting down a decommissioned weather satellite with its ASAT rocket under the programme Mission Shakti, ISRO successfully launched a military satellite EMISAT along with 28 foreign satellites in its own launch vehicle PSLV C45, a new variant of PSLV with four strap-on motors. While the former demonstrated its ability to shoot down any moving hostile object in space to safeguard its outer space limits and the space assets deployed there, the latter clearly showed its capability to launch multiple satellites from single launch system. Two years ago, ISRO also successfully launched 104 satellites by a single rocket including 101 foreign satellites to create a new milestone in space history. ISRO also made its intention clear last year to undertake the greatest feat in space exploration, that is, to launch a human into space by the year 2022. ISRO plans to launch a string of other satellites this year as part of its ongoing space programme. All these evidences point out at the growing emergence of ISRO as the world's leading space power and its dominant role in deciding the fate of space exploration in the days to come.

Demonstration of Technology

By shooting down a space target, India became the fourth nation in the world to demonstrate the ASAT weapon system technology in space after USA, Russia and China which the Prime Minister has

commented as an indigenous effort to make India stand tall as a space power. Mission Shakti, according to him, was a highly complex manoeuvre, conducted at extremely high speeds with remarkable precision that shows the remarkable dexterity of India's outstanding scientists and the success of its space programme.

By launching EMISAT along with a host of 28 satellites, India scripted history by making many firsts in space exploration. So far, India used airplanes to track down enemy sites. However, the defence satellite EMISAT will ease the process of locating enemy radars by intercepting radar signals from measurement of electro-magnetic spectrum.

Outer Space: A Strategic Frontier

Mastering outer space has become an inevitable necessity for national security considering the militarization of space by various nations in recent times. As the future wars will be predominantly fought from space based platforms, India's recent endeavors of space showcase its commitments to exploit this very important domain of strategic frontier.

Because most communication and spy satellites are deployed in outer space, it will be the sole priority for any country to first neutralize these enemy objects in the event of a war. This would include shooting them down with ballistic missiles from earth or torching with laser beams directed from anti-satellite platforms in space. The loss of the so-called "Eye in the Sky " devices would blind-fold the enemy and reduce its capability considerably to launch an effective fight in the war.

Notable Developments

A notable development in this direction is the contribution of industries outside ISRO to the growth of country's space sector which is evident from the fact that industries have contributed nearly 95% hardwares to the PSLV C45 mission. Another significant development is the close association of ISRO with defence establishments like DRDO which means ISRO's expertise will benefit our defence sector immensely in fields like spying and surveillance and anti-terrorist operations. The third thing is the growing faith of foreign nations over ISRO's capability of launching their satellites as this has a huge potential of earning foreign revenues.

Looking Ahead

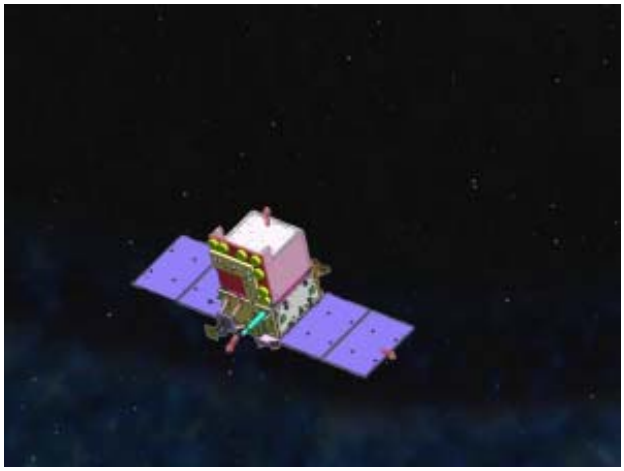
The year 2019 being the birth centenary of the founding father of Indian Space Programme, Vikram Sarabhai, ISRO plans for a year long celebration with a host of activities and missions.

The mission series would comprise launch of 32 spacecrafts including the most

complex Chandrayaan-2 and the development flights of Small Satellite Launch Vehicle (SSLV). Chandrayaan-2 mission, costing nearly Rs 800 crore, is an advanced version of the Chandrayaan-1 mission launched about 10 years ago primarily to remotely map the Moon for its mineralogical resources. The Chandrayaan 2 , to be launched on board GSLV-Mk III launch vehicle , would be a totally indigenous mission, comprising an Orbiter, Lander and Rover.

Among other missions, ISRO also aims to reinstate its microwave remote-sensing capability through the RISAT (Radar Imaging Satellite) series and attain operational Geo-imaging capability through the GISAT series. It is also planning to progressively improve the payload capability of GSLV (Geosynchronous Satellite Launch Vehicle) and its variant launch vehicles. ISRO would also try to meet the high bandwidth requirement of the Digital India programme and also the in-flight connectivity with the launch of GSAT-20 spacecraft.

Similarly, the Union Cabinet has already given its nod for the Rs 9,023-crore Human Spaceflight Gaganyaan programme which was first announced by the Prime minister Narendra Modi on 15tth August, 2018 on the occasion of its 72nd Independence Day from the ramparts of Red Fort. The objective of the mission is to carry a three-member crew to a low earth orbit and return them safely to a predefined destination on earth. Most of the critical technologies and hardware required for accomplishing such a mission have already been tested by ISRO including the flight of a crew module in space and its re-entry into atmosphere, environment control and life support system inside the crew capsule and various safety provisions like the crew emergency escape in case of launch abort. It will not be difficult for ISRO to clear the remaining hurdles in the field like the selection and training of astronauts, designing of space suits and selection of healthy foods for them etc. ISRO is also actively upgrading its tracking and telemetry system to monitor the mission round the clock with its network of tracking stations around the globe. If everything goes right, three Indian astronauts will be lifted off from a re-furbished launch pad at Sriharikota by a GSLV Mark III launch vehicle in a 7000 kg crew capsule and circle



the Earth for seven days in a low earth orbit of 300 to 400 km. During its nearly five decades long illustrious career, ISRO has come of age and certainly has the capability and world class expertise to put a man into space.

Concerns and Aspirations

Although some agencies have raised concern due to the generation of space debris from the destruction of the satellite possessing threats to their space assets including International Space Station, ISRO downplays the claim by asserting that the experiment has been carefully chosen in the low earth orbit where the fragments will eventually enter the atmosphere and burn up as harmless pieces. Our Prime Minister also silenced the critics by terming the programmes as peaceful and harmonious exploration of space. The peaceful use of space includes global communication, navigation, and weather forecasting, remote sensing, development of new materials in zero gravity conditions among many other applications which have a great scope of benefitting the mankind. As ISRO is expected to test many technologies and devices in space as part of its ongoing space ambitions, many path breaking discoveries would unfold that would spill out of its main research line and eventually permeate the whole of mankind contributing to progress and development.

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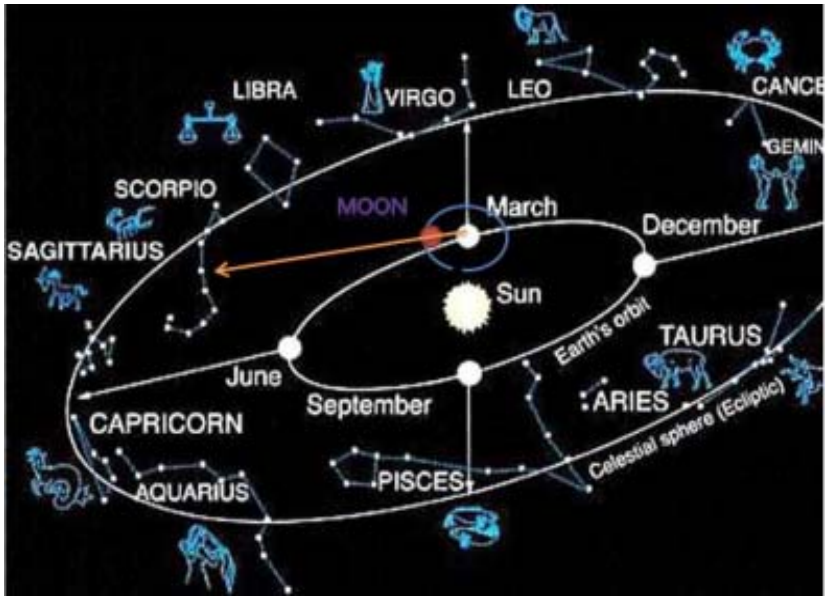
ALMANAC ASTRONOMY AND ASTROLOGY

Sudhira Panda

Almanac is the living breath of Indian culture. We may say it as the heart of Hindu Society. In every moment of life, from birth till death (funeral bed) from beggar to the king or president in all society, people feel the importance of almanac. However, our society never bothered to know about the origin and correctness of this almanac on which people are so dependent. It is worthwhile to know from where it has come, how and why it has been introduced in the society. Simultaneously, it is also important to know the correctness of the almanac. While following the almanac it always comes to mind that if we do not follow almanac strictly then we shall face hell lot of problems.

Besides this and nakshatras, everyday morning when we see the newspaper our eyes automatically go towards RASIPHALA. A curiosity to know in advance how today will pass.

In English newspapers, we could see the date interval along with RASI.i.e the person born between 21st March to 20th April holds Aries (Mesha) rasi and the person born between 21st April to 20th May holds Taurus (Brushava) rasi and so on. However, RASIPHALA in regional newspapers do not have these specifications. Why is it so?



As we know, our solar system lies in a corner of our galaxy Milky Way surrounded by specific clusters of stars. We call them the constellations of the zodiac. When Earth orbits Sun in ecliptic, it seems as if Sun orbits Earth. At the same time, it seems as if Sun passes all 12 constellations of the zodiac. This phenomenon gives a feeling that Sun takes around 30/31 days to pass one constellation of the zodiac. Therefore in English or European calendar, it has been mentioned the Sun's position in the zodiac. In other words, it says that the person holds the RASI in which Sun lies at the time of his birth. The European astrologers believe in the positional effect of Sun on the zodiac at the birth time of a person, which regulates his future. However, there is some deviation found in Hindu almanac. The Hindu astrologers believe in the combined effect of Sun and Moon's positions in zodiac for the same and they give more preference to concentrate on the Moon's position rather than Sun's position.

From the modern astronomy, it is known that Moon takes around 27.237 days to orbit Earth. However, full moon to full moon or new moon to new moon it takes 29.5 days, since Earth passes round $27^{0}20'$ ahead by that time. To keep this hidden truth in mind, ancient Indian astronomers made some rearrangements of 12 constellations of the zodiac into 27 nakshatras, so that it will be easy to assume that moon takes one day to pass one nakshatra of the zodiac. There is a beautiful myth to support the scientific truth. The story is as follows.

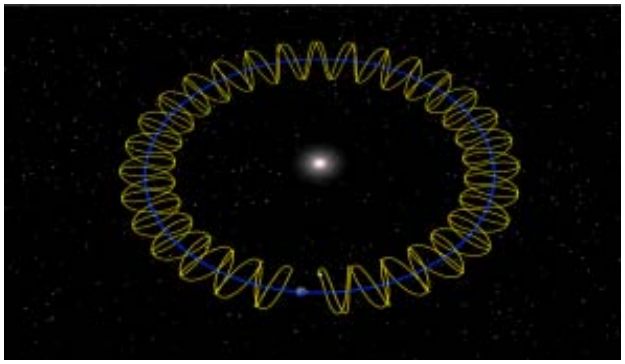
Moon had married all the 27 daughters of king Dakshya, who are the 27 nakshatras in the sky. However, Moon was more inclined towards Rohini and loved to spend time with her. Other wives (nakshatras) complained to their father(king Dakshya). The repeated request to Moon by king failed to change Moon's attitude. Therefore, the king became angry and cursed Moon, causing it to wane in size. Moon started diminishing in size. Since the consequences of this were not good, all Devas intervened and requested king Dakshya to withdraw the curse.. The king was given assurance that Moon would visit all his wives and since the curse could not be revoked completely, Moon would regain his strength for half a month, that is the reason Moon transits all 27 nakshatras in a month completing the zodiac orbit causing Amavashya (new moon) and Purnima (full moon) by waxing and waning in size.

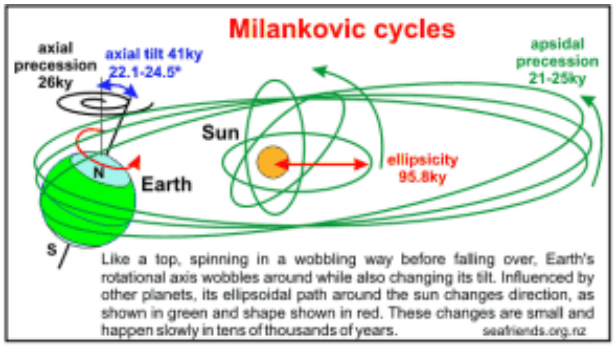
Ancient Indian astronomers subdivided each nakshtra into 4 padas for a better accuracy in calculations. Possibly, the 108 rudrakhya in our sacred chain for chanting represents 27 x 4 = 108 padas of the zodiac which may be interpreted as follows. The PUNYA you will gain by chanting God's name for 108 times is equivalent to the PUNYA of once orbiting the constellations of the zodiac and the whole Universe.

One rasi (constellation of the zodiac) consists of nine padas. For example, four padas from Aswini, four padas of Bharani and one pada from Krutika together makes the rasi Mesha (Aries) and so on. The concept of nakshatras (constellations) is used in Vedic astrology for accurate predictions and astrological analysis. Janma nakshatra is the nakshtra in which the Moon is placed at the time of birth of a person.

As we know from modern astronomy, Earth takes 24 hours to spin and simultaneously takes 365 days to orbit Sun. Since Earth inclines 66.5^0 to the ecliptic, the place where the direct rays from Sun falls on Earth changes every day and causes seasons as Earth orbits Sun. If we join these points where the Sun's direct rays fall, it will become a continuous line leading to a circle known as ecliptic. This ecliptic spreads from 23.5^0 N to 23.5^0S latitude. As mentioned before, the Sun takes 30/31 days to pass one constellation of the zodiac. The day of entry of Sun to a constellation is called Sankranti and date of escape is called Masanta (end of month). The beginning of these months starts from Mahabisuba sankranti (equinoxial day), the day when Sun's direct rays fall on the equator (Bisubarekha). The position of Sun on 23.5^0 N and 23.5^0S are named as Karkata (Capricorn) Sankranti and Makara (Cancer) Sankranti respectively. In these days Sun enters constellation Capricorn and Cancer respectively. The meaning of sankranti could be on the kranti (latitude) or with the kranti. Some confusion arises at this point. According to Hindu almanac, Makara sankranti and Mahabisuba or mesha sankranti falls on 14^{th} of January and 14^{th} of April respectively. However, according to modern European calculations, Sun's direct rays falls on 23.5^0S and on equator on 22^{nd} of Dec. and 21^{st} of March respectively. These dates are approximately 24 days earlier to our traditional calculation, which is a big confusion. To know the truth, I have taken some observational data from the gnomonic shadow. Surprisingly, those observational data supports the European calculations. After a deep study on this problem, I became little clear about the discrepancies in ancient Indian and modern European calculation. The discussion is narrated below.

It has been observed that the Earth orbits Sun like a spinning top. As a result, it could not reach at the same point from where year calculation starts, at the end of the year. To reach the initial position it takes approximately 25800 years i.e every year it errs around 1/25800 part of the small cycle. This error is named as precession. However our ancient Indian astronomers called it Ayanamsha (a part of ayanagati or a part of the annual motion).





The rate of ayanamsha differs slightly in different Siddhants. The table is given below.

TABLE-1: ZERO AYANAMSA YEAR AND ANNUAL RATE OF PRECISSION

Siddhanta	Annual rate of precession	Zero year of equinox in C.E.
Surya Siddhanta	54"	499
Soma Siddhanta	54"	499
Laghu-Vasistha Siddhanta	54"	499
Grahalaghava	60"	522
Bhasvati	60"	528
Brhatsamhitas, Manjula (Quoted by Bhaskara-II)	59.9"	505
Modern data	50.27"	

Since modern calculations have been made by taking the observational data using powerful telescopes and artificial satellite images and calculations are made by taking the help of computer, naturally these information may be more correct in comparison to our traditional calculations. So error in traditional calculation is around 15% to 20% in comparison to modern one.

Besides these, it is found from the research and observations that no parameter in Universe is constant. For example, Earth doesn't always incline 66.5^0 with the ecliptic (Sun's plane). This inclination varies from 65.3^0 to 67.4^0 in a period of 11000 years. Again the Earth also changes its path every time while orbiting Sun in a cyclic period of 10,000 years. Also the path of Earth orbiting Sun is not always elliptic in nature. It varies from nearly circular to highly elliptic in nature in a period of 41000 years. The Sun's plane with respect to Earth changes between 5^0 to 7^0 in a cyclic period of 100,000 years. The picture is given below

It is very difficult to take all these parametric changes into account while preparing the Almanac. Therefore, to avoid these complicacies European almanac makers adopted tropical year calculations instead of sidereal year following Babylonian and Egyptian calculations.

The first round of correction started in 50 B.C.E. , when it was found that the equinox shifted around three months from the predetermined time. In 46 B.C.E., Julius Caesar with the help of philosopher and astronomer Sosigenes added 67 days with the year to reset the actual dates of the equinoxes to those specified in the calendar. To bring a permanent solution to this problem, they decided to keep solar year as 365 days and every 4^{th} year to be a year with 366 days. This calendar was known as new Julian calendar . In this calendar 1^{st} January and 21^{st} March was

fixed as beginning of the year and equinoxial day respectively. That was not the end of the correction. It was found that tropical years (equinox to equinox) is little shorter in comparison to sidereal year i.e. tropical year completes one cycle in 365.2422 days where as sidereal year is 365.2564 days. Therefore, it accumulates around 0.0142 days error every year and sums around 3 days over a period of 400 years. The error was so tiny that it could not be noticed for few hundred years. In thirteenth century, some astronomers and philosophers could know it. However, there was a wait for 300 years to make the correction over it. In 1582 C.E., Pope Gregory XIII established the correction and made it universal. He implemented that though the year divisible by 4 is a leap year, the year divisible by 100 is not, unless it is divisible by 400.Therefore, it was decided to keep the year 1600 C.E. and 2000 C.E. as leap year with 366 days unlike 1700 C.E., 1800 C.E., and 1900 C.E. as the year with 365 days. In this process, intercalated 3 days were adjusted in a time span of 400 years. Since by that time Julian Calendar had already accumulated extra 10 days, 10 days were deducted from Julian calendar and renamed as Gregory calendar. In this new calendar, 4th October 1582 C.E. was read as 14th October 1582. It has been decided that 4000 C.E. and 8000 C.E. will not be a leap year and 20000 will be. This calendar was accepted throughout the world, though in India, China and Islamic countries have their own religious calendar.

Surprisingly, the non-catholic countries like England, Scotland and America didn't accept the corrections and Gregory calendar. Later again in 1752 C.E., Gregory calendar was accepted universally. The error was accumulated one more day by that time. Therefore 11 days were deducted from Julian calendar i.e. 3rd September 1752 was read as 14th September 1752 C.E.. A reflection of this correction can be seen in our computer system (UNIX or LINUX), in which 3rd Sept. to 13th Sept. is missing.

It is sad to know that, no such extensive study has been made in India. Though Surya Siddhanta had dealt with the liberation of equinox i.e. an oscillation about the fixed point of Aswini, the text says that there are 600 such to and fro oscillations in a mahayuga of 4,320,000 years, the period of one such oscillation being 7200 years. The position, according to this text, would be that in the first 1800 years of Kali, it moved forward uniformly by 27^0 to a point 20' beyond with respect to the star Bharani and then in the next 1800 years i.e. till 498 or 499 C.E., it would oscillate backward to the first point Aswini and this regression would continue till 2299 C.E. till it reaches 27^0 behind Aswini. Thereafter it would start moving forward. Besides these, no other information are found in our Indian traditional calculations. Only the Indian almanac makers added 7 intercalated months in a time span of 19 years to balance the Luni-Solar calendar and have not taken any step to adjust the error accumulated due to precession.

After the above discussions, we may have a look to our present day religious calendar, according to which we are observing Mahabisuba Sankranti (equinoxial day). However, according to modern European calendar, Sun has already passed equinox on 21st March, 24 days before we observe. We also say Mahabisuba Sankranti and Mesha sankranti. Now the question arises, "Does Sun lie on the constellation Aries (Mesha) on 14th April?" To have a concrete information the data table of NASA (National Auronatic and Space Research) and ISRO (Indian Space Research Organisation) is given above which are available in internet.

Name of Constellation	Position of Sun (information from ISRO)	Position of Sun (Old information NASA)	Position of Sun (New information NASA)
Capricorn	Jan. 20 – Feb. 16	Dec. 23 – Jan.20	Jan. 9 – Feb. 15
Aquarius	Feb. 16. – March 11	Jan. 21 – Feb. 19	Feb. 16 – March 11
Pisces	March 11 – April 18	Feb 20 – March 20	March 12 – April 18
Aries	April 18 – May 13	March 21 – April 20	April 19 – May 13
Taurus	May 13 – June 21	April 21 – May 21	May 14 – June 19
Gemini	June 21 – July 20	May 22 –June 21	June 20 – July 20
Cancer	July 20 – Aug. 10	June 22 – July 22	July 22 – Aug. 9
Lio	Aug 10 – Sept. 16	July 23 – Aug. 21	Aug 10 – Sept 15
Virgo	Sept. 16 – Oct. 30	Aug. 22 – Sept 23	Sept 16 – Oct. 30
Libra	Oct 30 – Nov. 23	Sept 24 – Oct 23	Oct 30 – Nov. 22
Scorpio	Nov. 23 – Nov. 29	Oct 24 – Nov 22	Nov. 23 –Nov 29
Ophiuchus	Nov. 29 – Dec. 17	Not a constellation of the zodiac	Nov. 30 – Dec. 17
Sagittarius	Dec 17 – Jan. 20	Nov. 23 – Dec 12	Dec. 18 – Jan. 8

I am sure, this data table will definitely disappoint our readers. Since the Sankrantis, we observe, no where matches with the real positions of Sun in the zodiac.

If we match the data table with our almanac, then we can realize how wrongly we are observing the rituals related to solar system. The discrepancies might have been happening due to precessional error of thousands of years. In India after the death of Bhaskara II, the progress of astronomy and science came to a standstill due to lack of patronage. The glorious India was weakened by the invaders after 11th century from Mongolians to British and Portuguese. No encouragement or patronage was given to scientists or astronomers. As a result, the chain reaction transfer of knowledge to the successors over the years got broken. In the present era, although the traditional almanac makers can identify the errors, they are incapable of rectifying them.

From critical investigations, I could understand that the present day almanac makers are just replacing calendar used 18 years ago, with new data of eclipses collected from European calculation, without going through the extensive calculation. Therefore, it is quite

unfortunate that the whole Hindu society is blindly accepting this calendar and consequently the RASI PHALA . If the calculation of Sun's position is erroneous, then all tithi related to Sun including Sankrantis follow the same.

Therefore, if we really want to follow almanac and RASI then it is necessary to have an extensive research in this direction.

For information, the Indian calendar Saka was introduced in the society in 76 C.E. by the Emporer Kaniska of Kusana Dynasty. And in 1957 C.E., by the instruction of the then Prime Minister Jawaharlal Nehru, a committee was formed under the supervision of Professor Meghanad Saha to accept Saka as the Indian national calendar. However, no step has been taken to eradicate the errors generated due to precession.

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UNMANNED AERIAL VEHICLES (UAVs)

Dr Pradipta Mishra

Remotely Piloted Aircraft (RPA), Autonomous Aircraft (AA) and Model Aircrafts are various subsets of Unmanned Aerial Vehicles or UAVs. RPA is an unmanned aircraft which is piloted from a remotely piloted system. UAVs are also colloquially known as drones. Drone is an unmanned aircraft that can fly both autonomously (without a human in control i.e computer guided) or can be piloted from a remotely piloted system.

The first pilotless aircrafts were built during First World War. These early modules of pilotless aircrafts were flown using radio control. In 1935, the British produced a number of radio controlled aircrafts to be used as targets for tracking purpose. It is thought that the term drone was started to be used during that time, inspired by the name of these modules, the HAVILLAND DH 82B Queen Bee. Reconnaissance Unmanned Aerial Vehicles were first deployed on a large scale in the Vietnam War. Following Vietnam War, other countries outside of Britain and the United States began to explore Unmanned Aerial Technology. The world's first quad copter was created in 1907 by inventor brothers Jackques and Louis Breguet. Based on the invention of NIKOLA TESLA in 1917, the Ruston proctor Aerial Target became the first pilotless winged aircraft in history. It was a radio controlled pilotless airplane. During

1960s, miniaturized radio controlled components were made available to consumers which brought revolution in radio controlled UAV industry. In the aftermath of 9/11, the United States in particular has significantly increased the use of drones for surveillance in terrains where troops are unable to move. Apart from being used in military operation, the UAVs (RPAs\AA\drones) have high potential use in civilian sector. Recognizing this, the Federal Aviation Administration (FAA) of US has issued the first commercial drone permission. Govt. of India has also formulated and made effective a policy on civilian use of remotely piloted aircrafts since 01 December, 2018.

As per the civil aviation requirement, the office of Director General of Civil Aviation (DGCA) has categorized the RPAs into the following five in accordance with the maximum All-up- Weight (including payloads):

I. Nano: Less than or equal to 250 gms

II. Micro: Greater than 250 gms and less than or equal to 2 kg.

III. Small: Greater than 2kg and less than or equal to 25 kg.

IV. Medium: Greater than 25 kg and less than or equal to 150 kg

V. Large: Greater than 150 kg

As per the new guideline of Govt. of India, all RPAs must have Equipment Type Approval (ETA) certification from Dept. of Telecommunication for operating the RPA on de-licensed frequency band(s). Similarly, all RPAs will have Unique Identification Number (UIN) and Unmanned Aircraft Operator Permit (UAOP) from DGCA. RPA in Nano category intended to fly up to 50 ft above ground level (AGL) in controlled airspace\enclosed permission for commercial\recreational purpose as well as RPAs owned\ operated by Aviation Research Centre and Central Intelligence Agencies are exempted from obtaining UIN. As per the new guidelines, each RPA system in India must have a remote pilot with UAOP. However Nano RPA operating below 50 ft AGL, micro RPA operating bellow 200 ft in uncontrolled airspace & clear of prohibited\ restricted\danger\temporary regulated & temporary reserved areas as notified by Airport Authority of India (AAI) as well as RPAs operated by National Technical Research Organisation (NTRO), Aviation Research Centre (ARC) and Central Intelligence Agencies are exempted from UAOP. But it is made mandatory that all RPA users shall intimate the local police prior to conduct of actual operations.

All RPAs (except Nano category intending to operate 50 ft AGL) are to be equipped with Global Navigation Satellite System (GNSS), Autonomous Flight Termination Systems or Return Home (RH) option, Flashing anti collision strobe light, Radio Frequency Identification (RFID) & Global System for Mobile communication (GSM) SIM card for real time tracking, flight data logging capability. In addition, all RPAs (except Nano & Micro category operating in uncontrolled airspace) intending to operate in controlled airspace up to 400 ft AGL are

required to be equipped with SSR transponder, Barometric equipment , geo-fencing capability and detect & avoid capability.

Operating Restrictions for RPAs in India

❖ No RPA shall be flown: -

a. Within a distance of 5 km from the perimeters of airports at Mumbai, Delhi, Chennai, Kolkata, Bengaluru and Hyderabad.

b. Within a distance of 3 km from any civil, private or defence airports.

c. Above the obstacle limitation surface (OLS) or PANS-OPS surface, whichever is lower of an operational aero drone, specified in ministry of civil aviation (Height Restriction for safeguarding of aircraft operations) rules, 2015 notified through gazette of India notification GSR-751 (E) as amended from time to time.

d. Within permanent or temporary prohibited, restricted and danger areas including TRA and TSA as notified in AIP.

e. Within 25 km from International border which includes line of control (LOC), line of Actual control (LAC) and Actual Ground Position Line (AGPL).

f. Beyond 500 m (horizontal) into sea from a coast line provided the location of ground station is on a fixed platform over land.

g. Within 3 km from perimeter of military installations/ facilities/ where military activities/ exercises are being carried out unless clearance is obtained from the local military installation/facility.

h. Within 5 km radius from Vijay Chowk in Delhi. However, this is subject to any additional conditions/restrictions imposed by local law enforcement agencies/authorities in view of the security.

i. Within 2 km from perimeter of strategic locations/ vital installations notified by ministry of home affairs unless clearance is obtained from MHA.

j. Within 3 km from radius of state secretariat complex in state capitals.

k. From a mobile platform such as a moving vehicle, ship or aircraft.

l. Over eco-sensitive zones around national parks and wildlife sanctuaries notified by Ministry of Environment, Forests and Climate Change without prior permission.

Various types of remote sensors can be fitted in one UAV for surveying, mapping and monitoring of individual parcel of the planet earth. In India, permission has been granted to fly UAVs up to a height of 400 ft AGL during day time only from nonmoving pilot station within visible line of sight. Beginning from normal video camera to infrared, microwave, light detection and ranging, hyper spectral etc. can be fitted in one UAV. With the right computing power and programming, UAVs can translate any landscape into a data point that can then be used in several ways. Surveying, mapping and real time monitoring of resources

like agriculture, forest, water, mines as well as assets/infrastructure's inspection through sensors fitted in UAVs have become operational in our country till date.

In civilian sector, UAVs can be used as a service. Spraying pesticides in crop field, delivery program for medical supplies, delivery of arms and ammunitions to the military camps in difficult terrains are some of the current uses of UAVs.

Recently, World Economic Forum (WEF) has announced its advanced drone operation toolkit (ADOT) developed in partnership with forty Govt. agencies, private enterprises, research organizations and civil aviation authorities. Andhra Pradesh, for the first time in the world, plans to utilize the insights from the toolkit to build a drone delivery program for medical uses, a use case that is of key interest for many countries.

Another application for UAVs, one that received much media attention when Facebook purchased solar drone company, Titan Aerospace is for the use of UAVs to bring internet access to the developing world. According to Mark Zuckerberg, it is planned to have a fleet of UAVs flying together at 60,000 ft. communicating with each other with lasers and staying aloft for months at a time something that is never done before.

Monitoring endangered sea lions in south Australian Bright National Marine Park, mitigating species like rats in the famous Galapagos Island in New Zealand coast saving the eggs of giant tortoises, remotely piloting an army of Drones laden with seed for implanting millions of trees by analyzing 3D map data in real time in Spain, real time detection of flames and smokes generated by forest fires, use of multiple drones helping the scarce number of environmental guards in Kenya for surveillance over elephant poachers, monitoring of typhoons in Philippines and monitoring the ice caps of Artic region are some of the examples of uses of UAVs in protecting and monitoring our planet Earth.

In the present scenario, in India, we need to train people not only how to fly the UAVs but also educate them around the current DGCA regulations and specific use cases. Young professionals must also be encouraged to pursue Unmanned Aerial Aircraft Operator Permit (UAOP) because the present UAV industries lack professionals with UAOP.

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FLU – 2
(SWINE FLU)

Prof. Prafulla Kumar Mohanty

What is Swine Flu?

Swine flu consists of two words namely "swine" and "flu". The term swine is a noun which has got its origin from Anglo-Saxon swin bearing the meaning pig. This appears to have resemblance with bovine and porcine. Both are objectives. Bovine (Lain-bos, bovis-an oxe or cow) means pertaining to cattle, whereas porcine (Latin porcinus or porcus – a swine) means pertaining to pigs or of pigs. The second part of the title is flu (or flue) is the shortened form of influenza. Influenza (Late Latin influentia means to flow into) is a highly infectious viral infection. So swine flu is an influenza caused due to an animal pig.

History

This viral infection is normally seen in epidemic form. Epidemic means sudden outbreak of infectious disease which spreads rapidly and affects a large number of people, animals or plants in a particular area for a limited period of time. The outbreak of H_1N_1 humans dates back to the 1918 Spanish influenza epidemic which infected one-third of the world's population and caused approximately 50 million deaths. Till August 1, 2010, more than 214 countries and overseas territories have reported laboratory-confirmed cases of H_1N_1 virus infection including over 18,449 deaths worldwide.

The first positive case of H_1N_1 in India was reported on May 16, 2009 in a 23 year old passenger who travelled from USA and arrived at Hyderabad airport. After that, the virus soon became epidemic and spread to almost all major cities of India. The mortality rate of H_1N_1 infection has gone up from 8% in 2012 to 23% in 2015. In 2013, total 643 people contracted the infection and 149 died; in 2012 total 1551 people were infected and 135 people died. In 2015, H_1N_1 death toll had reached 62 in Gujarat, 66 in Uttar Pradesh, 81 in Rajasthan, 5 in Maharashtra and 3 in Karnataka.

Outbreak of H_1N_1 influenza

Influenza or flu is caused due to flu virus. Flu virus is of three types such as A, B and C. A and B cause flue in animals which are highly dangerous. B type is more dangerous than that of A. In fact, only B infects human beings. C is not that much harmful. Type A virus infects birds. The naming of flu virus is coined as HN in various numbers. That means, the virus which attacks pigs, its name is H_1N_1 and H_3N_2. But virus attacking birds are named as H_5N_1. H stands for "Hemagglutinin" and N stands for "Neuraminidase". Both H and N are two different types of proteins which are present on the outer side of the virus (Fig.1). H_1N_1 virus is spherical in shape having

nucleoicapsid protein and segmented (-) strand RNA gene.

H_1N_1 influenza is an extremely infectious respiratory disease in pigs caused by one of the several swine influenza A viruses. H_1N_1 virus transmission to humans is unusual, but it can spread to humans through infected pigs or contaminated environment. Once it infects a human being, it leads to human to human transmission apparently in the mode similar to that of seasonal influenza and can spread thereafter at an unprecedented rate.

Signs and symptoms

Patients infected by the viruses usually show symptoms of acute respiratory illness like fever, cough, sorethroat, bodyache, headache, chills and fatigue along with diarrhoea and vomiting. In children, signs of severe disease include aphea, tachypnea, dyspnea (respiratory problems), cyanosis (blue colouration), dehydration, altered mental status and extreme irritability.

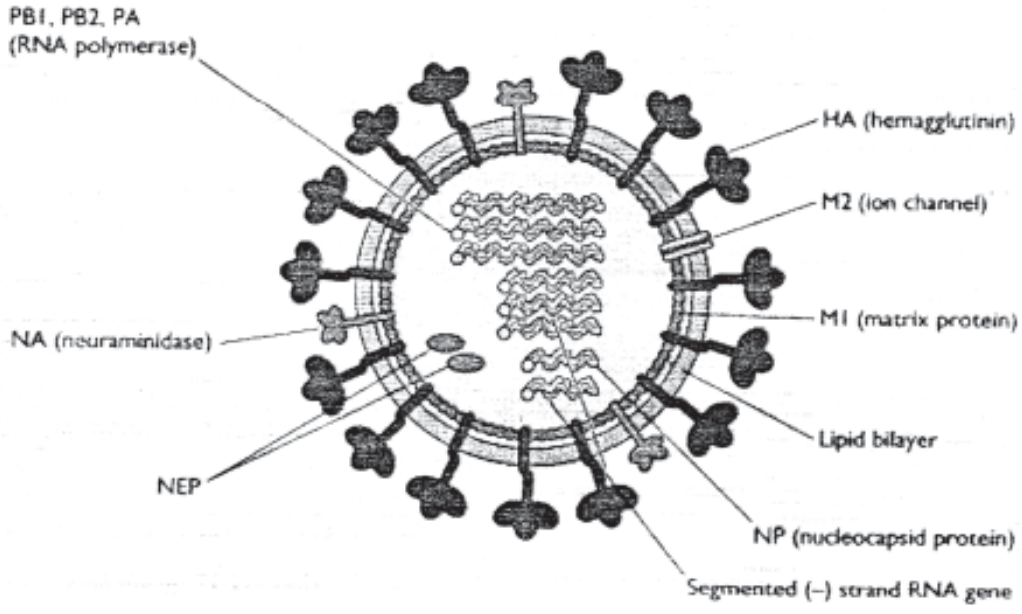
Diagnosis

Centre for Disease Control and Prevention have diagnosed following criteria for suspected H_1N_1 influenza.

1) Onset of acute febrile respiratory illness within 7 days of close contact with a person who has a confirmed case of H_1N_1 influenza virus A infection, or
2) Onset of acute febrile respiratory illness within 7 days of a travel to a community where one or more H_1N_1 influenza A cases have been confirmed, or
3) Acute febrile respiratory illness in a person who resides in a community where at least one H_1N_1 influenza case has been confirmed.

Prevention and Management

Following preventive measures and management need to be undertaken.



H_1N_1 Virus

1) Vaccination is the best way to protect from flu. Everyone, six months of age and older should get vaccinated against flu.
2) Hands and body should be cleaned and washed with soap and water or an alcohol-based hand rub. Everybody should avoid touching eyes, nose or mouth because viruses or germs spread this way. Close contact with infected people must be seriously avoided.
3) Treatment involves use of cough suppressants, antipyretics and analgesics. Adequate bed rest and increased fluid consumption are largely supportive in the management.
4) Severe cases may require intravenous hydration and other supportive measures.
5) Antiviral agents may also be considered.

Conclusion

The proverb "Health is wealth" appears to be quite valuable as far as health and diseases are concerned. When diseases are caused due to infection, we all should be careful and cautious from the infected persons and source of infections. By this, we can overcome and avoid the problems to a large extent. But one of the most significant steps of this problem is to keep ourselves away from the animals like pig. So a saying is to be recollected and remembered which is as follows.

"No safety, Know pain. Know safety, No pain."

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HIGH CHOLESTEROL DON'T CAUSE HEART ATTACK

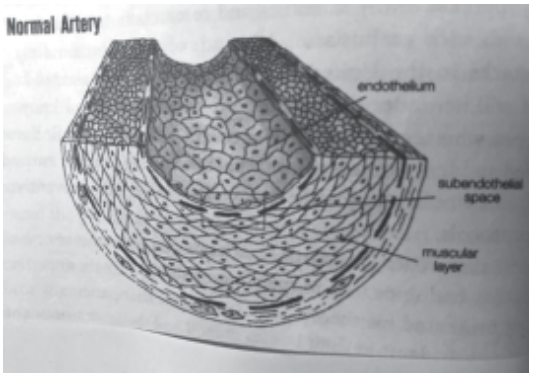
Dr. Dwijesh Kumar Panda

Heart attack remains the number – one cause of death in the world. There are 1.5 million heart attacks each year in the United States and about one-half are fatal. Sadly, about half of these deaths occur within the first hour of a heart attack. The first sign of heart disease in more than 30 percent of cases is sudden death. Cholesterol is not the culprit behind heart disease as the media suggest. The inflammation of the arteries of the heart is the main cause. More than half of heart attack patients in the United States have normal cholesterol levels. This finding is revolutionary to the treatment and prevention of heart attacks. It is necessary to decrease the cause of inflammation in the arteries of the heart.

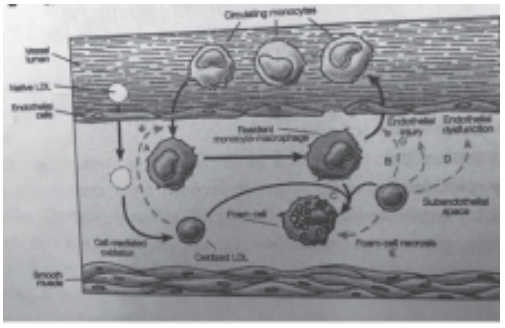
Elevated cholesterol in the blood is not considered a risk factor for coronary artery disease and stroke. During 1972, the normal cholesterol level was considered between 280 to 310 mg/dl. The Framingham (Massachusetts) studies in the late seventies considered greater than 200 as abnormal and the level more than 240 placed the patient at high risk of developing a heart attack. In the early 1980s physicians began to learn that not all cholesterol was bad. The HDL (High Density Lipoproteins) cholesterol is actually good, and the higher it is, the better. It is the LDL (Low Density Lipoprotein) cholesterol that is bad. LDL cholesterol accumulates along the artery walls, forming plaque and narrowing the arteries. The HDL cholesterol cleans up the artery.

LDL cholesterol is really not "bad". God didn't make mistake when He created it. Native LDL, the kind that the body originally makes, is good. In fact, it is essential for building good cell membranes, other cell parts and many different hormones that our body need. We can not live without it. Our body makes this form of cholesterol if we don't get enough from our diet. When free radicals change or oxidize native LDL cholesterol, this modified LDL cholesterol is truly "bad". Dr. Daniel Steinberg postulated that patients having adequate antioxidants can suppress oxidization of the LDL cholesterol not to become bad (New England Journal of Medicine- 337 (1997), 409-415). Other researchers also concluded that highest levels of antioxidants in the bodies indeed had the least amount of coronary artery disease.

LDL cholesterol isn't the only instigator behind inflammation of the blood vessels. Other main causes include *homocysteine,* the free radicals that cigarette smoking, hypertension, fatty foods and diabetes cause. The cross section of a medium-sized artery (Figure 1) shows the endothelium (first layer of cells) is made up of sensitive cells and underneath is the muscular layer. Between these two layers is the sub endothelial space. This is where all the damage takes place (Figure 2). The native LDL cholesterol becomes trapped in the sub endothelial space where it can be easily oxidized if adequate antioxidants are not available. The oxidized LDL cholesterol is then easily "gobbled up" by the monocyte till it is "stuffed" with fat. This does not happen if the LDL cholesterol is not oxidized. It becomes a "Foam cell "which causes damage to the sensitive lining of the artery by creating oxidative stress. This leads to injury and dysfunction of the endothelium resulting in hardening of the arteries. The oxidized LDL



(Fig-1)



(Fig-2)

Cholesterol, homocysteine and excessive free radicals cause injuries to the endothelium. Inflammation takes place and it is the initial step of *atherosclerosis.*

Chronic inflammation is the underlying cause of heart attacks, strokes and peripheral vascular disease. During an inflammatory response, the release of nitrous oxide is blocked from the endothelium, causing the endothelium to function poorly. Chronic inflammation causes the muscle of the artery to thicken by proliferation of thicker muscle cells to build up plaque and narrow the artery.

Platelets adhere to the plaque and the artery around it goes into spasm. The plaque rupture in about 50 percent of heart attacks and the clot forms around causing acute and abrupt total closure of the artery. The lifestyle changes necessary to slow down or even hopefully reverse this devastating disease is to be taught to the patients so that they never have to end up in the surgeon's hands.

The antioxidants can eliminate or at least significantly reduce all of the causes of inflammation in the arteries. Vitamin E incorporates itself with LDL cholesterol and protected from becoming oxidized even if it passes into the sub endothelial spaces. The monocytes pick up and drop off native LDL cholesterol to buildup plaque and prevent the entire inflammation process. Vitamin C has got the similar function and the ability to regenerate vitamin E and intracellular glutathione. Glutathione is a key antioxidant and is present within every cell. Bioflavonoids exist within our fruits and vegetables. Red wine and grape juice contains polyphenols which decrease the formation of oxidized LDL cholesterol. Research scientists are discovering that the root cause of heart disease is inflammation resulting from oxidative stress. To halt oxidative stress, the body needs enough antioxidants to handle all the free radicals. All these nutrients work together either to eliminate or to decrease the inflammation in the arteries. That is why cellular nutrition is so critical to our heath.

The new tests for heart disease are Ultrasensitive CRP, Homocysteine blood levels and heart calcification scores. The highly sensitive C - reactive protein (hs CRP) measure the arterial inflammation currently present. Homocysteine blood levels above seven micromoles/L are responsible for 15 percent of all the heart attacks and strokes in the world today. This major killer can be prevented by taking folic acid, vitamin B12 and vitamin B6. The amount of calcification or plaque buildup present in coronary arteries can be diagnosed by CT scan.

More than half the people who suffer from heart attacks have normal cholesterol levels. Like aspirin at a cost of rupee a day, vitamin B supplements can effectively lower the majority of elevated homocysteine levels. The medical community and the pharmaceutical industry roll billions and billions of dollars in each and every year by selling cholesterol lowering synthetic drugs. Public health is notoriously unprofitable. People don't make a profit preventing disease. They make a profit through medicine- treating critical, advanced stages of disease.

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FLORAL FEAST

Prof. (Dr) Ramesh Chandra Parida

Flowers are the most artistic creation of Nature. Those fire our aesthetic sense , inspire our creative imagination and constitute an integral part of our social, cultural and spiritual lives. Infact , these are the nature's noblest boon to the mankind, as those produce not only the seeds that are the sources of our life – sustaining nutrition, but also create the new generation of plants to keep our environment livable. Besides , while providing feasts to our eyes, many of those can also form an important part of our menu to trickle our taste buds and to supplement our nutritional needs, in order to ensure good health.

In our country, the flowers that are commonly consumed include cauliflower , agathi, moringa, drumstick, nisorha, banana, pumpkin, mahua, sannhemp, silk cotton, water lily, neem, onion, and cucumber. Besides , flowers like marigold, rose, cornflower are also edible. Some flowers are available in plenty in all seasons and some others are seasonal. However, most flowers are rich in various micro-nutrients like minerals, vitamins, anti-oxidants and essential amino acids (Table-1), besides having unique ingredients that have protective as well as curative properties. For example, a cup of raw borage contains 31.2 mg of vitamin C, an equivalent to 47% of the daily requirement of a woman (74 mg) and 35% that of a man (90 mg). Similarly , it delivers 3 mg of iron, more than one-third of the quantity that a man needs per day (8 mg) and one – fifth of a woman's need (18 mg). It is also rich in calcium. On the other hand , a cup of pumpkin flower has 643 IU of vitamin. A (28% of 2300 IU an average woman and 21% of 300 IU a man needs in a day) and can meet about one-fifth of the daily iron requirement of an average person. Besides, while rose and lavender are rich in vitamin E and A respectively, the latter has an useful quantity of calcium.

Flowers are rich sources of phytonutrients, flavonoids and anti-oxidants. For example, marigold flower contains such flavonoids and zeaxanthins in useful quantities that protect cell damage, help eye and age related disorders. Similarly, while charysanthmus is a good source of anti-oxidants that protect against many fatal diseases including cancer and coronary diseases, violet flower contains ingredients that promotes blood vessel health and reduces inflammation. The medicinal properties of some flowers are depicted in Table-2.

However , there are also certain flowers which are toxic. Those contain different alkaloids and other ingredients that may cause paralysis, asthma, allergy etc. Some such flowers are water hemlock, deadly nightshade, white snake root, castor bean, rosary pea, oleander, tobacco, datura, calla lily, hycinthus, horse chest nut, opium, belladonna, yellow jasmine and sweet pea. Therefore , we should be very careful in choosing the flowers for food and should never try the unknown ones.

Table – 1; Nutritive Contents of Some Edible Flowers (per 100g)

Edible portion %	Moisture(g)	Protein (g)	Fat (g)	Minerals (g)	Fiber (g)	Carbohydrate (g)	Energy (Kcal)	Calcium (mg)	Phosphorus (mg)	Iron (mg)	Carotene (Microgm)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vitamin C (mg)
Agathi (Sesbaniaaegyptiaca)		93	1	0.5	0.4	0.8	4.4	2.6	9	5					
Cauliflower (Brassica oleracea var. botrytis)	70	91	2.6	0.4	1	1.2	4	3	33	57	1.5	3	0.04	0.1	1
Drumstick (Moringaoleifera)		86	3.6	0.8	1.3	1.3	7.1	50	51	90					
Nisorha (Cordiadichotoma)		80	4.7	0.5	2.6	3.3	9.1	61	1740	116					
Banana (Musa sapietum)		43	89.9	1.7	0.7	1.3	1.3	5.1	34	32	42	1.6	2.7	0.05	0.02
Pumpkin (Cucurbitamixima)		89	2.2	0.8	1.4	0.7	5.8	39	120	60					
Sannhemp(Crotalaria juncea		79	4.8	0.6	1.4	3.9	10.4	66	200	100					
Silk cotton (Bombaxmalabaricum)		86	1.5	0.3	0.7	1.6	9.5	47	22	45					
Water lily (Nymphaeanoucchali)		91	1.6	0.6	0.7	0.9	5.4	33	29	18					
Mohua (Bassialatifolia)	89	19	4.4	0.6	2.7	1.7	72	311	140	14	15	23	0.03	0.88	5.2

Table -2: Medicinal Properties of some flowers.

Flower	**Medicinal Properties**
Peonies	Relaxant, helps in cramps and muscular pain.
Plums flower	Used in the Chinese system of medicine to boost immune & digestive system.
Rose	Digestive.
Sunflower	Treatment of ulcer and abdominal pain.
Lilac	Reduces fever, fights parasites, soothes burn and wound.
Lotus	Reduces temperature during fever and is also used in the treatment of diarrhea and bronchitis.
Morning glow	Has hallucinating effects, reduces labour pain and is a laxative.
Chrysamthemus	Reduces pain and fever and soothes eyes.
Begonia	Cures headache , burns and inflammation and flushes away toxins.
Dandelion	It is a laxative and blood cleaner.
Jasmine	Cures menstrual pain, inflammation, indigestion and insomnia and cuts and bruises.

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PLANT RESURRECTION

Raj Ballav Mohanty[1]
Taranisen Panda[2]

Resurrection means to revive and come back to life or a rising from the dead. In Christian belief, resurrection is the event when Lord Jesus became alive three days after his death. It is of course not possible in animal kingdom. But in the plant world, a condition arises when more water from their body is lost by transpiration, than is absorbed. It causes cells to loose their turgor and plant structure particularly leaves drop, called wilting of plants. They can of course recover from that state within hours if water become available. Permanent wilting and possible death can result if the plants does not access to water for a prolonged period. But some plants, which can survive extreme dehydration and desiccation (less than 5% relative water content) even over months or year and revive again are generally called resurrection plants. These are the plants, actually not coming back to life after death, rather coming out of the dormant, ametabolic state induced by severe dehydration. Resurrection species are more common in Lichens, Bryophytes, rare among Pteridophytes and Angiosperms and not seen in Gymnosperms. This phenomenon is observed in more than 1300 different plant species, including about 300 Angiosperms. They display considerable geographic and habitat diversity. In fact, most of these plants are herbaceous species who inhabit desert or temperate areas with extended period of drought. To adapt to extreme dehydration, these plants have developed unique molecular mechanisms to protect themselves against desiccation induced damage. Two most common resurrection species are "*Anastatica hierochuntica"* a cruciferous plant also called as the "Rose of Jerico" and a club moss named '*Selaginella lepidophylla*'.

THE MECHANISIMS OF SURVIVAL

When completely dried and appears to be dead, these plants exist in a quiescent, desiccated state. Their metabolism is at or near zero along with a significant reduction in cell and tissue volume. During the dry season, the color of the plant changes and branches curl inwards forming a rather dead looking ball. Desiccation tolerance in those plants involves a combination of molecular genetic mechanisms, metabolic and anti-oxidant systems as well as macromolecular and structural stabilizing process. Briefly the onset of water loss apparently sets in to motion a series of cellular events like dehydration followed by activation of desiccation related genes, ulteration in metabolisms and production of protective proteins. Alteration in metabolisms involves the accumulation of protective solutes like "sucrose" "trehalose" and "proline" that stabilize proteins and cellular

membranes, production of antioxidant compounds and biochemical alterations in membranes and cell wall composition. There is also production of protective proteins like "Dehydrins" and "Expansins" that helps in preserving the structural integrity of intercellular organelles and the cell walls. However, the total process of series of changes, mode of survival under extreme condition and resilience are yet to be clearly known to the modern science.

IMPORTANCE AND UTILITY

1. If the cellular mechanisms for such remarkable drought tolerance are clearly understood and the genes involved are identified, it may be possible to use this knowledge to improve the drought tolerance in crop plants. In fact, scientists are working on it to detect and isolate the concerned genes.
2. The remarkable geographical and habitat diversity of these species has contributed to the diverse array of genes and metabolites which they utilize for stress protection and environmental adaptation. These unique metabolites have recently attracted much attention with respect to their potential to be used in biotechnology and medicine. In fact, these metabolites are reported to display biological activities of importance to medicine having antibacterial, antifungal, antiviral and anticancer properties and can be utilized for development of novel drugs as well as cosmetics.

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Earth Day

April 18th is observed as "Earth Day" since 1970 to create awareness among the people to save our Earth from pollution and protect our environment. This year's theme is, "Protect our Species". Nature's gift to Earth are the millions of the species that we know and many more to be discovered. Man has upset the balance of nature due to various activities so that extinction of many species have occurred. Now is the time to correct ourselves and save the Earth and its species.

"EL-NINO", THE KILLER OCEAN CURRENT

Prof. (Dr.) Basant K. Mohapatra

Even though "El-Nino" phenomenon has been discussed at international level by climatologists before 1970, it came for discussion in India when several areas in our country became drought affected.

Actually, "El-Nino" is a warm Pacific Ocean current observed in the Pacific east-coast of some South American countries like Peru, Ecuador and Northern Chile. Under normal circumstances the waters of eastern Pacific of Ecuador, Peru and Northern Chile are surprisingly cold, as much as 10°C cooler than the waters of western Pacific ocean. There are plently of fish in this part of eastern Pacific ocean, since this cold water is rich in nutrients. Anchovy and sardine type fish are plenty in these waters as a result of which Peruvian fishery became world's largest off-shore fishing since 1950s.

But once in every five to ten years from December to March, the waters of eastern Pacific warm upto 28°C, (4°C higher than normal) which disrupts the nutrient rich cold water, as a result, almost the whole of anchovy fish die. Peru is covered partly by desert and its economy mostly depends on fish and fish products. Birds eat the fish and deposit "guano" (dung) around their nesting places, which are harvested by Peruvians and sold as a very rich fertilizer. Due to "El-Nino" large scale death of fish leads to disaster of Peruvian economy.

The name "El-Nino" came from the Spanish language meaning "Christ-Child-Son" as it occurs in December. The Pacific east-coast countries Peru, Ecuador and Chile have Spanish language. "El-Nino" appears almost in every 5-10 years and its effect remains from December to March. Very strong effect of "El-Nino" was observed in middle of 1970 and 1982. In 1982, due to large scale death of fish, about 100,000 fishermen had no income and it was disastrous for the economy of Peru and Chile. Thus, in 1982 effect of "El-Nino" attracted the attention of international scientists.

"El-Nino" effect not only resulted in death of fish around Pacific east-coast, but it has affected the climate of half of the countries of the world. Due to its effect sand storm in Australia, severe storms in "Tahiti" island (Pacific ocean), drought in Africa and severe flood in California coast of U.S.A. There were severe storms in the Pacific coastal countries of South America and 300 times rainfall in Peru. Apart from this, drought occurred in north east Brazil, north part of China, Indonesia and eastern Australia. Also severe flood occurred in Ecuador, Bolivia and Peru. Due to warm waters of east Pacific ocean,

atmospheric air became warm resulting in low pressure and consequently heavy rain in coast of Chile to South California. Because of the creation of low pressure, the drought occurred in some parts of world and heavy rain and flood in other parts. These are all due to the "El-Nino" effect on climate.

"El-Nino" is not a regional wonderful phenomenon. This phenomenon is irregular, but occurs repeatedly. It has a relation with "Southern oscillation". Southern oscillation is an irregular but repeatedly occurring atmospheric condition. Between "Tahiti" (Pacific ocean island) and Darwin (Australia) of Indian ocean, the relation of atmospheric pressure and temperature of the air above the ocean is called Southern oscillation which is called "ENSO" by the climatologists. Southern oscillation is the atmospheric component of "EL-Nino". This component is the oscillation of air pressure over the waters of east and west Pacific ocean. The power of southern oscillation is measured by Southern oscillation Index (SOI). It is found from the difference of air pressure over the water of "Tahiti and Darwin". When "SOI" is negative, "El-Nino" occurs.

In 1990 January-February, warmest climate was in U.S.A., and drought in Singapore, Indonesia and Thailand were observed due to 'El-Nino' effect. Possibly, the drought situation of 2013 in India was due to "El-Nino" effect.

Appearance of very cold water in Pacific ocean is caused by "ENSO" and is called "La-Nina" which means "girl child". During this period trade wind becomes powerful and water of east Pacific ocean becomes very cold. Because of "La-Nina", heavy rain occurs in South Africa and East Africa becomes dry. During this period equatorial storm occurs in China, and heavy rain in Malaysia, Indonesia and Philippines. Also relatively more rain in U.S.A. and Canada and heavy snowfall in Europe occurs.

It is impossible to prevent "El-Nino". Steps can be taken ahead of time to meet its disastrous effect in the affected South American countries. To predict the appearance of "El-Nino", it is necessary to record the air temperature over the waters of Pacific coast of Peru and the difference in air pressure over the waters of Tahiti and Darwin. For this, South Pacific Commission has been formed with membership of Chile, Peru, Ecuador and Columbia. Scientists of this commission have floated 200 buoys over east Pacific ocean fitted with sensors, satellite transmitters and thermostats etc. to collect temperature of ocean water, level of salinity and air samples, so that they can predict the appearance of "El-Nino" before several months. By this, they can warn the fishermen, farmers and government officials of these countries to get prepared for the disaster.

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■

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AN UNFAMILIAR DOMAIN OF INDIA'S ANCIENT TEXT

Dr. Nikhilanand Panigrahy

"The day science begins to study non-physical phenomena, it will make more progress in one decade than all the previous centuries of its existence." *-Nikola Tesla*

(10 July 1856- 7 January 1943).

Tesla, a pioneer of AC electricity supply system was an engineer and futurist. He had devoted much time in the field of wireless transmission.

Tesla's emphasis on non-physical phenomena (quoted above) provided food for thought, in the science-world. In a blog, Tina Englich has elaborated this, " … These things, especially things like 3rd eye are considered non-physical phenomena, they cannot be explained or proved by physical methods. Therefore the only proof of their existence is your believe and this is how you can use them." (22nd November 2013).

When one looks at the career of Tesla, he will find that he was engrossed in experimental science. In spite of this (of course, in addition to this), he had a fascination for non-physical phenomena to enrich science. This novel and unconventional approach requires more or less the use of a third eye. This, to a great extent, is outside the realm of laboratory and many scientists will disagree with him.

In this context, we may look at the age, when sophisticated scientific tools were not available. This leads one to go into the remote past and delve into the history of science in the beginning stage. Question arises: Was there actually any recognisable science , as we understand it now-a-days? This needs introspection, for which we take the help of the following illustration.

With the advance of medical science, now people are living longer. But unfortunately, this has resulted in some acute health-problems. One such example for our concern is the spread of Alzheimer's disease. Keeping in view the seriousness of this ailment, world Alzheimer's Day is celebrated on 21st September each year, to make people conscious about this growing menace.

As we age, we may suffer from this ailment. In majority of cases, it happens for persons above the age of 65 years. Of course, 5 percent of cases also take place in the age of 40's and 50's. Among other things, its symptoms include loss of memory and dementia. The victim becomes incapable of remembering names, recognising known persons, and other such normal things—even relating to the recent past. Besides he loses his ability to perform daily needs, like speaking and walking. He suffers from confusion and unfounded suspicion, while dealing with familiar friends and relatives.

Scientists have shown that we have synapses in our brain. These are the junctions, which connect the neurons. In a nervous system, neurons (or nerve cell) carry nervous electrical

impulses. Actually, the neurons are the working-units to send, receive and store the signals, that add to a person's information. A nervous impulse passes from one neuron to another through synapse. If for some reason or other, the neuron is impaired, smooth passage of signals will be affected, resulting in problems for memory.

In case of persons, suffering from Alzheimer's disease, it is observed that some proteins in the brain are incorrectly folded, so that the protein-structure loses its functional shape or conformation. This miscoding of protein fragments (amyloid–beta) will cause plaques, which surround the synapses. Thus the communication network inside the brain is disrupted, resulting in memory-loss. This is suspected to be one of the causes of the Alzheimer, which falls under the umbrella–term of dementia.

Unfortunately, the reliable cure of this disease is still under medical investigation. It will be wiser for us to keep intact the power of our memory, even if we age. In the medial temporal lobe and under the cerebral cortex of the brain, a small organ called hippocampus (Horse-shoe shaped) is found. This is regulating not only long-term memory, but also short-term and spatial memory. For strengthening memory regular exercise is advised, as this can increase the size of hippocampus. It is to be noted that the size of the hippocampus shrinks in late adulthood, which can be a source to lower memory.

So the strength of memory very often depends upon the activities of a person. A simple example is memorising mathematical arithmetic tables, that was taught compulsorily in primary schools in the past. Of course, now this practice is given a good bye due to advent of many electronic devices, starting from a humble calculator.

Apart from this, there is another example, which can check our memory-loss. This is associated with the regular and continuous recitation of Sanskrit shlokas, provided the Sanskrit words therein are pronounced properly.

Usually the westernised modern youth detests all things, good or bad, pertaining to ancient India, which also includes the language of Sanskrit, naming it as a dead language.

But we should remember the warning, explicitly expressed by Sri Aurobindo:

"Whoever wishes to cut off the nation from its past is no friend of our national growth .. we must acquire for her the best knowledge that Europe can give her and assimilate it to her own peculiar type of national temperament."

(Quoted in New Indian Express, 15.10.2018)

One major cause of Alzheimer's disease can be alleviated by removing the plaques around synapses. Recently a group of researchers of MIT in Cambridge, Massachusetts (U.S.A.) have observed that if a mice is exposed to light and sound waves of frequency 40 Hertz, the plaques of the mice will disappear. Taking this clue as a guide, an Alzheimer's disease patient may be subjected to such treatment. For this, deep meditation is suggested for the patient, as meditations can produce waves in the range of 25-100 Hertz, with an average of 40 Hertz. This has been verified in reality on the basis of data, collected from the brains of meditating yogis. (Ref: Chanting could reduce Risk of Alzheimer's, Anil K. Rajvanshi, Times of India, 22 August 2018).

Coincidentally, the *Mantra* vibrations have a similar effect. If the *mantras* in Sanskrit are recited properly, then nasal and sonorous sound generate 40 Hertz brain waves. The construction of our brain is such that the auditory and visual cortex are located in the same section. This togetherness is a welcome feature of the brain.

AUM (om/ Pranab/ Brahma Nada) has special significance in this context. It is regarded as a universal syllable. This cosmic sound is above any religion or , for that matter, any other sectarian consideration. This is described as that sound, which created the universe something like, in the big bang theory.

The AUM (Om) *Mantra* covers syllables, each one of which has a speciality, if we look at the vibrations they create in the body, when intently recited. Each such vibration is associated with a particular part of our body, as follows:

aaaa ….→ Associated with the resonance of nervous system of stomach and chest.

oooo ….→ Nervous system of throat and chest.

mmmm….→ Nervous system of nasal cavity, skull and brain.

These three syllables, being components of AUM, are capable of transmitting energy upwards from abdomen to brain. In this process, the spinal cord and brain will be activated. If the recitation of the *mantra* is practised regularly, depression and epilepsy can be averted.

This has been attested by scientists, basing on the analysis of functional Magnetic Resonance Imaging Scans (f-MRI Scans).

(Ref: Analysis of Acoustic of OM Chant to study its effect on nervous system—Ajay Anil Gurjar, Siddharth A. Ladhake, Ajaya P. Thakare, IJCSNS International Journal of Computer Science and Network Security, No. 1, January, 2009, pp.63).

This is relevant to prevent Alzheimer's disease, as the plaque on the synapses will not get any scope to be formed. This can be stated in other words that the deep hum of OM produces 40 Hertz which is the real remedy essential in this case. The farsighted Patanjali *rishi* (estimated to have lived between 2nd century BCE to 4th Century CE), who has been regarded as the propounder of Yogasutras, enumerated that Yoga is the suppression of modifications of the mind. This can be aptly applied for various mental afflictions, above all, Alzheimer's.

In this context, we can quote the following:

"Though hundreds of years of oppressive colonial rule could not kill India's soul, it certainly left scars of inferiority in our mind and deep sense of mental slavery that we have still not able to tide over. This inferiority complex conspicuously reflects in the ever increasing sense of contempt towards our language, tradition, culture, custom, food and education".

— Kailash Satyarthi, Nobel Laureate (New Sunday Express, 21 October, 2018)

Let us not turn our head only towards the alluring success of modern science, but examine the ancient text as well, to establish and accept the scientifically verified knowledge of our country.

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ROBERT KOCH:
Father of Scientific Study of Tuberculosis

Professor Guru Prasad Mohanta

Tuberculosis (TB) is an ancient contagious disease and cure is available. In spite of having effective cure, more than 4 lakh people continue to die every year due to TB in our country. Now, India plans to eliminate TB by 2025 and war against the TB has begun. It was a German scientist who contributed significantly, more than a century ago, to TB research leading to finding the cause of TB and proved to the world that *Mycobacterium tuberculosis* is responsible for causing TB infection. He was Robert Koch, a doctor cum bacteriologist, who won the Nobel Prize in Medicine in 1905 for his investigation and discovery in relation to TB.

[1843 - 1910]

Koch was born on December 11, 1843 in a village in north western part of Germany and his father was a mining engineer. He was the eldest of 11 children of his father. At an early age of just five years, he surprised his parents telling that he had taught himself 'how to read' with the help of newspapers. This is the feat of unique intelligentsia and methodical persistence. At the age of 19, he joined medicine programme at the University of Gottingen and qualified with MD degree in 1866. During his study on medicine, he was greatly influenced by his Professor of Anatomy, Friedrich Gustgav Jacob Henle. Henle was credited with publications claiming that the diseases were caused by living parasitic organisms. Later he studied chemistry in Berlin.

During late 1860s, Koch worked as Assistant in General Hospital at Hamburg for a brief period. On passing District Medical Officer's examination, he volunteered to serve German Army as Medical Officer in Franco-Prussian War. On discharge from Army, he became the District Medical Officer of Wollheim from 1872 to 1880. During this period, he was gifted with a microscope on his birth day by his wife. With this, he established a primitive laboratory in his flat and his research made him famous in scientific communities.

Pasteur's germ theory of infectious disease (1862) gave the momentum for the search of causative organisms of various infectious diseases. Prior to the research findings of Koch, much scientific details of

TB was not known except that TB could be inoculated from man or cow to rabbit or guinea pig. The sputum of consumptive could infect a rabbit with TB. It was not known what causes TB. It was Koch, just of 39 years, who announced his discovery of tubercle bacillus in the meeting of Berlin Physiological Society on 24th March 1882. He isolated and identified the tubercle bacillus from the lungs of animals which had died three to four weeks after infection. It was his maiden speech before such a distinguished gathering. This was a historic event. When the news of discovery of cause of TB spread around the world, Koch became a house hold name. The world observes this 24th March as TB Day every year. Later in 1890, in the 10th International Medical Congress held in Berlin, Koch announced that he had a substance which retarded the growth of tubercle bacillus, cured tuberculosis in guinea pigs and would probably be useful in the treatment of TB infection in human. Though initially, he refused to divulge the details, he revealed it as tuberculin. It was the filtrate from a growth of tubercle bacilli on glycerol broth. Though 'tuberculin' was found to have no curative value but became the diagnostic tool for TB. In brief, Koch's discovery of tubercle bacillus and tuberculin revolutionised the management of Tuberculosis.

Koch laid the foundation of modern bacteriological techniques: introducing glass slides and cover slips, examination by hanging drop, fixing and staining of bacteria, culture on solid media by poured – plate method, microphotography, and disinfection by steam sterilisation. In 1876, Koch demonstrated the life cycle of anthrax bacillus and for the first time showed that the specific organism is cause for a definite disease. Koch was also credited for isolating cholera vibrio and formulated strategy for the control of cholera. The strategy suggested by Koch was approved by the Great Powers in Dresden in 1893. For his work on cholera, he was awarded a prize of 100,000 German Marks.

At a time when people still believed that most of the diseases were due to poisonous 'bad air' or 'cause of curse', Koch's discovery of finding the cause of cholera, anthrax, and TB showed a new dimension to disease management. Besides Nobel Prize, Koch received many prizes, medals, honorary doctorates during his life time. He occupied many coveted positions like Professor and Director of Institute of Hygiene in the University of Berlin, Surgeon General Class I, Free man of City of Berlin and Director of Infectious Diseases. Even posthumously, he was honoured by memorials. Koch Crater on the Moon was named after him. The Robert Koch Prize and Medal were instituted to honour scientists who make ground breaking discoveries or who make unique contribution to the global health. At the age of 66, Koch died of heart attack. Because of his pioneering work, he will always be considered as one of founders of modern microbiology.

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CANNIBALISM IN ANIMALS

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Introduction

The survival of the fittest is the ageless law of the nature. The fittest are those endowed with the qualifications for adaptation, the ability to harmonize with existing or changing conditions. In the living world, especially in the animal kingdom, there is no waste in functioning natural ecosystems. All organisms, dead or alive are potential sources of food for some other organisms. This happens under normal and suitable living conditions. But sometimes certain uncommon and incidental phenomenon takes place in nature under unfavorable conditions.**Cannibalism** is one of such phenomenon. It can be defined as 'eating of own kind'. This is very largely a result of the natural struggle for survival or procreation and not an evil aberration. The animals exhibiting cannibalism are known to be **'cannibals'.**

History

The word *cannibal* is derived from Spanish word *cannibals* describing "carib", the tribe who were rumored to be man eaters, recorded by Christopher Columbus (1492) in his first voyage and he learned about it from the natives on the North-West coast of Cuba.

Types of cannibalism

Cannibalism is a type of Intra Guild Predation (IGP). IGP is the killing and eating of potential competitors. This interaction represents a combination of predation and competition, because both species rely on the same preys and get benefit from preying upon one another. It can be either **asymmetrical** (one species consistently preys upon the other) or **symmetrical** (both species equally prey upon each other). IGP depends on factors like size, growth, population density and behavior of the shared prey.

Cannibals can either be **active**, who hunt and kill their conspecifics before eating them or **passive**, who feed on already dead members of their own species. The factors responsible for cannibalism are scarcity of food, overcrowding in population, environmental stress, improper parental care etc.

Nature is witnessed with the coexistence of predators and preys. In cannibalism, both predator and prey belong to the same species. Approximately 140 species of animals are known to have cannibalistic tendencies. Animal cannibalism can be of four basic types.

1. Sexual cannibalism
2. Survival cannibalism
3. Filial cannibalism
4. Intrauterine cannibalism

Spiders are the most deadly cannibals. They exhibit **sexual cannibalism** where the female kills and consumes the conspecific male before, during or after mating. This may

increase female's fertility and ensures the potential survival of the species. It is observed mostly in two species of spiders such as *Latrodectusmactans* (black widow spider) and *Latrodectushasseltii* (red back spider) (Figure 01).

Fig.01 Sexual cannibalism in red back

In some species (*Pissaura mirabilis*), male spiders protect themselves from pre copulatory sexual cannibalism by offering a nuptial gift to the females. This nuptial gift is in the form of a small insect wrapped in a piece of silk (Figure 02).

Fig.02 Male offering nuptial gift to female spider *(L. hasseltii).(P. mirabilis)*.

Stegodyphuslineatus, another species of spider, found in the Mediterranean basin and Asia exhibits **matriphagy**(Figure 03). The babies start their life as cannibals and their mother becomes their first victim. The mother spider regurgitates food and lets her babies feast on her liquefied gut and get consumed by them.

Fig.03 Matriphagy in spider *(S. lineatus).*

Praying mantises (*Mantis religiosa*) are known to exhibit sexual cannibalism where female individuals eat their male partners after sexual intercourse as it may increase their fertility and ensure the potential survival of the species (Figure 04).

Fig.04 Sexual cannibalism in praying mantis *(Mantis religiosa).*

Mormon crickets (*Anabrus simplex*) exhibit **competitive cannibalism** which

occurs due to limited food resources. They go on a march in a group when they have shortage of proteins and salt in their diet. Those crickets that cannot move as quickly as others move get eaten by their fellows (Figure 05).

Fig.05 Competitive cannibalism in mormon

It is not only the offspring that becomes cannibal, but sometimes the parents also turn into cannibals. Seventeen families of **Teleost fishes** exhibit filial cannibalism where the cannibalistic parents either consume their whole brood (**total filial cannibalism**) or eat only some of the eggs in the nest (**partial filial cannibalism**). This consumption of offspring might be an adaptive strategy of parents to maximize lifetime reproductive success, for nutritional gain and to reduce the consequences of brood overcrowding. Filial cannibalism is more prevalent when mate availability is high as parents can more easily replace the consumed young ones.

Sand tiger sharks (*Carchariastaurus*) exhibit **intrauterine** or **embryonic cannibalism** where the stronger and larger first embryo cannibalizes on other younger siblings (adelphophagy) and unfertilized eggs (oophagy) in the mother's womb during gestation. Females have two uteri and they carry hundreds of eggs. During their fertile period, they can mate with many males, but each time, they give birth after twelve months of pregnancy. They produce just two offspring, one from each uterus (Figure 06).

Fig.. 06 Intra uterine cannibalism in sand tiger cricket*(Anabrus simplex).*
Shark *(Carchariastaurus).*

Competition among animals is very common when the food resources are limited. Larval **tiger salamander (***Ambystomatigrinum***)** often occurs in nature as a "typical" morph that feeds mostly on aquatic invertebrates and as a larger, faster developing "cannibal" morph that feeds on conspecifics (Figure 07). These cannibals

Fig.07 Cannibalism in tigersalamander

occasionally choose between eating a relative and a non-relative. They first of all avoid eating their kin and help them to reproduce.

The young **caecilians** exhibit matriphagy. They get their first meal by stripping off the skin of their mother's body. They use their specialized teeth to peel off a fatty layer of nutrient rich flesh from the outer skin of mother (Figure 08).

Fig.08 Cannibalism in caecilian. *(Ambystomatigrinum).*

Some animals are not born cannibals, but the unfavorable environmental circumstances force them to be so. **Polar bears (***Ursusmaritimus***)** largely lie within the Artic circle and spend most of the month at the sea. They usually feed on seals which they hunt from the platform of sea ice. But the melting of glaciers as a result of rising global temperature has made it more difficult for them to hunt seals at the sea confining bears to the land. This has led to malnourishment and starvation as polar bears are unable to build sufficient fat reserves for winter. So, they hunt each other for food in their desperation to survive. This type of cannibalism is known as **survival cannibalism** (Figure 09). Apart from

Fig.09 Survival Cannibalism in polar bear

polar bears, ***Hippopotamusamphibious*** (Figure 10) is also reported with such cannibalistic behavior. Although it's a herbivore, yet food and nutrition scarcity has made it a cannibal for its survival.

Fig.10 Cannibalism in *Hippopotamus. (Ursus maritimus).*

Infanticide and cannibalism is observed in several animals like **lions**

(Pantheraleo) (Figure 11)**, chimpanzees** *(Pan troglodytes)* (Figure 12)**, orangutans and bonobos** *(Pan paniscus).* By this behavior, the adult males increase parental investment to their young ones and allow females to become fertile faster. Since females do not ovulate during lactation, the males kill the young ones in order to prevent the lactation in females, so that they can easily reproduce. Sometimes the adult male kills and cannibalizes the previously dominant male after fighting to prove the final act of dominance.

Fig.11Cannibalism in lion *(Pantheraleo).*

Fig.12 Cannibalism inchimpanzee *(Pan troglodytes).*

Animals have evolved protection to prevent and deter potential predators such as those from their own kind. Many amphibian eggs are gelatinous and toxic to decrease edibility. Adults lay their eggs in crevices, holes or empty nesting sites to hide their eggs from potential conspecific predators which tend to ingest the eggs for an additional nutritional benefit or to get rid of genetic competition. Parental presence at nesting sites is also a common method of protection against infanticide committed by conspecific individuals, whereby the parent exhibit defensive displays to ward off potential predators.

King cobras *(Ophiophagus hannah)* are well known for eating snakes of different species, but recently it has been reported that they are also exhibiting cannibalism. The National Geographic channel displayed a video where a male king cobra killed and cannibalised the female. The reason behind their cannibalistic behaviour is still unknown (Figure 13).

Fig.13 Cannibalism in king cobra

Some animals are known to exhibit self cannibalism by eating their own body parts. Domestic cats eat their placenta after giving birth to their young ones to get additional nutrition (Figure 14). North American rat snake is reported to bite their own tail when kept in captive condition. This is perhaps due to unavailability of food (Figure 15).

Fig.14 Placentophagy in cat.
(Ophiophagushannah).

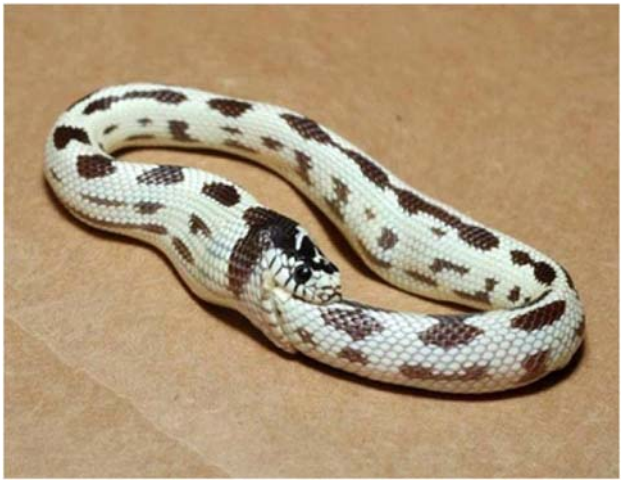

Fig.15 Self cannibalism in North American rat snake.

Cannibalism is not only confined to the animal kingdom, but has also been observed in human beings, called **anthropophagy**

Fig.16 Anthropophagy.

(Figure 16). Unlike animals, who cannibalize their conspecifics for a variety of reasons, human beings were known to cannibalize either for their survival or as a ritual. Most of the tribes in parts like, Papua New Guinea, Fiji Islands, New Zealand, Meso America, South America, Democratic Republic of Congo, Cambodia, Liberia etc. are still known to practise cannibalism as a cultural norm. It is again of two different types. The first one being ***endo-cannibalism*** (eating of the flesh of the human of same community or tribe after death) and the second one is ***exo-cannibalism*** (eating of the flesh of stranger or outside the close group). Anthropophagy is associated with certain deadly diseases. The most epidemic one was kuru during the early 20^{th} century. It was the first human Transmissible Spongiform Encephalopathy (TSE) or prion disease identified, while consuming the brain of the corpse, occurring in the Fore linguistic group of Papua New Guinea. Its discovery also led to the transmission of Creutzfeldt –Jakob Disease (CJD). Individuals who were homozygous for

the 129 Met allele of the gene (PRNP) encoding for prion protein (PrP) were most susceptible.

Advantage of Cannibalism

Cannibalism is a very common ecological interaction in the animal world. It can be advantageous. In an environment, where food availability is constrained, individuals can receive extra nutrition and energy, if they use other conspecific individuals as an additional food source. An increase of size and growth would give them the added benefit of protection from the potential predators. It also reduces the intraspecific competition.

Disadvantages of cannibalism

Cannibalism is also considered as the darker side of evolution. It has several disadvantages also. A predator that eliminates conspecifics can reduce its own inclusive fitness if the victim is a close relative. A predator can face increased risk of injury, if it attacks an individual with similar fighting abilities. Cannibalism also increases the risk of pathogen transmission as the encounter rate of hosts increases.

Conclusion

Cannibalism is not an aberrant behavior limited or confined to highly stressed population, but is a normal response to many environmental factors. It may vary considerably among different populations or genetic strains of the same species and among closely related species. The genetic basis of this behavior is very less known and it is still a question mark. Cannibalism may result in population self regulation, while predation among individuals of competing species tends to "regulate" the total biomass.

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EVOLUTION OF THE PERIODIC TABLE

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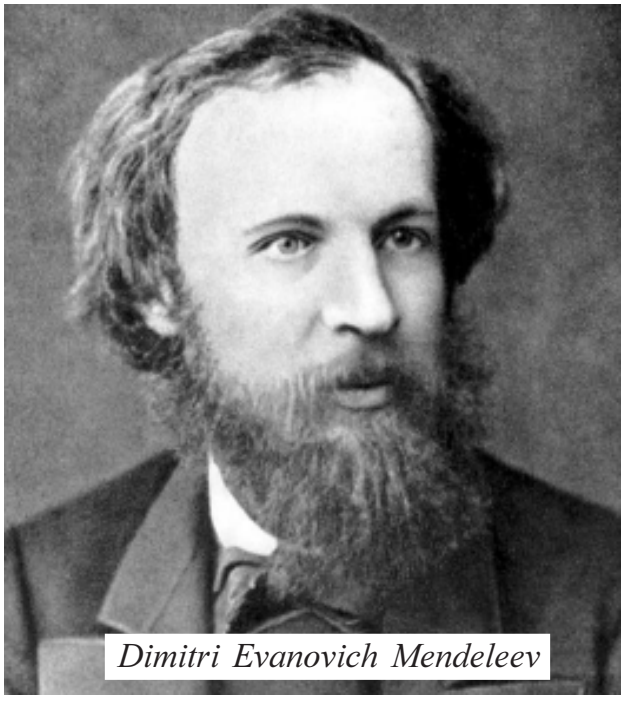
The year 2019 is observed as the international year of the periodic table all over the world. Although the evolution of the periodic table (PT) can be traced back to about 200 years, historians typically mark the formal birth of the modern periodic table on Feb 17, 1869 by the Russian professor of chemistry Dimitri Evanovich Mendeleev, who completed the first of his numerous periodic tables on that day.



Dimitri Evanovich Mendeleev

It included 63 known elements arranged according to increasing atomic weights. Mendeleev also left spaces for yet undiscovered elements for most of which he predicted atomic weights and some of their properties.

The discovery of the periodic table for classifying elements represents the culmination of a number of scientific developments rather than a brainstorm on the part of one individual.

1. In 1782, French chemist Antoine Lavoisier and his colleagues devised a list of 33 elements known at that time. The power of the modern table lies in its 2- or 3-D display of all the known 118 elements.
2. In an early attempt to organize elements in a meaningful array the German chemist Johann Dobereiner pointed out in 1817 that many of the elements could be arranged by their similarities which he called triads; e.g. Li, K, Na all react explosively with water. He further showed that the atomic weight of the middle element was close to the average of the weight of the extremities.
3. The French geologist Alexander Emile de Chancourtois positioned the elements according to the increasing atomic weights along a spiral on the surface of a cylinder and inclined at 45 degrees from the base.

a. The first full turn of the spiral coincided with the element O and the second full turn occurred at Ag. Elements lined up vertically on the surface of the cylinder possessed similar properties. This pattern became central to Mendeleev's system for a number of reasons.

Alexander's table was not accepted because it did not include the diagrams of the table.

4. Newlands was the first person to devise a periodic table of chemical elements arranged in order of their relative atomic masses. Continuing Johann Wolfgang Döbereiner's work with triads and Jean-Baptiste Dumas' families of similar elements, he published in 1865 his 'Law of Octaves', which stated that 'any given element will exhibit analogous behaviour to the eighth element following it in the table.

5. Around the time Mendeleev developed the periodic table in 1869, Julius Lothar Meyer of Germany, while revising his chemistry book in 1868, produced a periodic table remarkably similar to Mendeleev; but his work was published in 1870 (publisher's delay). This fact led to acrimonious dispute for priority.

6. Besides, Mendeleev had sufficient confidence in his table and devoted his lifetime to predict several new elements and properties of their compounds. The most important of M's discovery of chemical periodicity is that he elevated his discovery to a law of Nature and spent his life defending its validity.

7. In 1894, William Ramsay and Lord Rayleigh discovered the element Ar and within the next few years Ramsay announced 4 other new elements: He, Ne, Kr and Xe.

a. In 1900, the German physicist Friedrich Ernst Dorn discovered radon. These are known as noble gases. The name Noble derives from the fact that the gases seem to stand apart from the other elements, rarely interacting with them to form compounds. Originally, Mendeleev's table did not have a provision to place such inert gases. However, physicists successfully incorporated the noble gases to the table in a new arrangement. They introduced an additional column between the halogens and alkali metals.

8. In Mendeleev's table, the second point of contention was regarding the precise ordering of the elements that involved the atomic weights. In 1913 the Dutch amateur, Anton von den Brocak, a theoretical physicist suggested the ordering principle lay instead in the nuclear charge of each atom.

9. Henry Mosley, working at Manchester University, tested this hypothesis in 1913, shortly before World War-I.

a. Mosley began by photographing the X-ray spectra of 12 elements, 10 of which occupied consecutive places in the PT. He discovered that the frequency of features called k-lines in the spectrum of each element were directly proportional to the sequence of integers representing the position of each successive element of the PT.

b. He proved that there is in the atom a fundamental quantity which increases by regular steps as you pass from one element to the next.

10. In 1920, Ernst Rutherford referred to this fundamental quantity as atomic number of the element. Mosley's work provided the details on how many empty places remained in the PT.
11. In 1904, JJ Thomson who discovered the electron proposed that atoms of a particular element contained a specific number of electrons arranged in concentric rings.

a. According to Thomson, elements with similar electronic configuration would have similar properties. Thompson thus provided the first physical explanation of the PT. He imagined the rings of electrons as lying inside the main body of the atom rather than circulating around the nucleus as we believe today.

12. Niels Bohr brought quantum theory to bear on the structure of the atom. He was also motivated by the arrangements of the atoms of the elements in the PT in 1930.

a. Bohr reasoned that elements of the same group might have identical structures. His model served to explain the lack of activity of the noble gases.

b. Bohr did not derive electron configuration from quantum theory, but obtained them from known chemical facts and spectroscopic properties of the elements.

13. In 1924, Wolfgang Pauli explained the length of each row of the PT. As a result, he developed the Pauli Exclusion Principle which states that no 2 electrons can exist in exactly the same quantum state which is defined by quantum numbers. The length of various periods emerged from the experimental evidence about the order of the electron cell filling up and from quantum mechanical restrictions of 4 quantum numbers that the electrons can adopt.
14. Werner Heisenberg and Erwin Schrodinger developed quantum mechanics during the 1920-1930s, but the theory has limited influence on the PT. The basic structure of Mendeleev's PT remains intact.
15. Einstein's theory of Relativity has later come into play to describe particularly the heavier elements of a group that show marked variation in properties from lighter congeners
16. PT remains at the heart of the study of chemistry. It remains as one of the most fruitful and fundamental iconic idea in modern science and its future developments. The only comparable discovery may be made to Darwin's thery of evolution. Unlike theories such as Newtonian mechanics, which have been falsified, the periodic table stands strong and integral to the study of chemistry.

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HOOCH TRAGEDY IN ASSAM

Dr. S. N. Swain

Recently one of the northeastern state of India suffered a huge blow due to alcohol poisoning.Till 24th February 2019 more than 160 died and 300 hospitalised in the Tea garden areas of Golaghat and neighbouring Jorhat district of Assam which were the worst affected districts. Two weeks before, similar incident occurred in two northern states of India i.e. Uttar Pradesh (UP) and Uttarakhand (UK) where more than 120 people died by the alcohol poisoning. Most affected districts are Saharanpur and Kushinagar of Uttar Pradesh and Haridwar of Uttarakhand. More than 3049 people and bootleggers have been arrested and 80000 litres of illegal and illicit country-made liquor have been seized across those states.This type of dangerous drinks are readily available during wedding, prayer meetings and multiple mass gatherings. This is available in white plastic pouches which cost only Rs. 10 to 30. Its local name is Lattha.This is prepared using ingredients like grain, cane sugar, barley and other fruit beverages. In Assam, the local name of this illicit and illegal alcohol is 'Cholai ' which uses laligur as raw material. In the past similar incident also happened. More than 156 people died in West Bengal in 2011, more than 136 died in Gujarat in 2009, more than 180 died in Kolar district of Karnataka and Krishnagiri district of Tamilnadu., more than 200 died in Cuttack district of Odisha.The other names of hooch are white liquor, white lightning, mountaindew, home brew, shiney and white whiskey. The Hoochinoo Indians of Alaska, a small Tlingit tribes (Hutsnuwu) were the first to use a typical brown beer. From that ancient times people are using hooch. Though alcohol is present naturally in brewed and fermented alcohols but some nested bootleggers add ethanol and methanol to it. Since methanol is a cheap substitute and easily available it is also added in place of ethanol.

TABLE : LIST OF ALCOHOLIC DEATHS IN INDIA

Sl.No	DATE	PLACE/STATE	PLACE	SYMPTOMS	TOTAL DEATH
1	11 Feb2019	Uttarpradesh Uttarakhand	Saharanpur,Kushinagar Haridwar	Nausea, Stomach ache	120
2	16Aug 2016	Bihar		Nausea, Stomach ache	16
3	June 2015	Maharashtra	Malad	Nausea, Stomach ache	102
4	Dec 2011	West Bengal		Nausea, Stomach ache	167
5	Dec 2011	Uttarpradesh	Saharanpur	Nausea, Stomach ache	143
6	July 2009	Gujarat		Nausea, Stomach ache	136
7	May 2008	Karnataka Tamilnadu	Kolar Krishnagiri	Nausea, Stomach ache	180
8	May 1992	Odisha	Cuttack	Nausea, Stomach ache	200
9	1982	Kerala	Vypeen	Nausea, Stomach ache	77
10	July 1981	Kernataka	Bangalore	Nausea, Stomach ache	308

Percentage of alcohol in beverages can be found by ABV i.e Alcohol By Volume. For liquor, whiskey, gin, rum and brandy percentage of ethanol is 34, for sherry and port percentage of ethanol is 17, for wine percentage of ethanol is 10-12 and for beer and cider percentage of ethanol is 1to 4. Using alcoholmeter and hydrometer we can know the percentage of alcohol after preparing them by fermentation and distillation process. A safe distillate burns with a blue flame and a tainted distillate burns with a yellow flame. Presence of lead in wine can be tested using radiator coil which gives red flame in flame test. Methanol is a poisonous chemical. It is also known as wood alcohol, wood spirit, carbinol, hydroxyl methane, and wood naphtha. It is a light, volatile, colourless, flammable liquid with boiling point 337K. It is miscible with water due to its capability to form intermolecular hydrogen bonding with water. By injecting orally a small amount, it causes blindness by damaging optic nerve. In excess, it causes death. Commercially, it can be produced from water gas and hydrogen in the presence of catalyst like chromium, copper and zinc at temperature of 623-723K and a pressure of 200 atm. Naturally from 01 kg of apple we can get nearly 1.4 ml of methanol. Beverages from grapes and berries contain pectins which contain galactose methyl esters. In the presence of pectin enzyme, this esters reacts with water to give methanol. Methanol is used as a solvent for paints and varnishes and also used as antifreeze for automobile radiators. Even 15 ml of methanol is fatal. In our liver, methanol is converted to formaldehyde in the presence of enzyme alcohol dehydrogenase and then converted to formic acid in the presence of enzyme aldehyde dehydrogenase. Formic acid is a poisonous chemical which is present in ants. When formic acid reacts with basic substance present in our body, it converts into formates. Formates are very dangerous for our body. It prevents the growth of mitochondrial cytochrome C oxidase and obstructs metabolic cycle of body. Cytochrome C is a small haem protein found in the inner membrane of mitochondria. This phenomenon decreases oxygen level in cells and blood which increases OSMOL gap of body and acidomia (acidity). Blood which is an excellent buffer always maintains its pH at 7.35. Excess alcohol changes blood properties, increases hydrogen ion and decreases pH level. Methanol poisoning not only damages kidney and liver but also causes cancer, liver cirrhosis and Alzheimer's disease. Women are more vulnerable for alcoholic drinking.

God has provided us so many other drinkable things like milk and fruit juice. Why should we take alcohol? Till now more than 2000 people died in India due to alcohol poisoning. Father of Nation Gandhiji says, 'There is everything on earth for need of people and not for greed of people'. Let's not drink liquor and contribute maximum in nation building and making a strong, vibrant and sustainable India. If all the youths of India will try then Gandhiji's dream of alcohol-free India can be achieved.

■

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QUIZ
ENERGY

Girish Chandra Tripathy

1. The Energy Conservation Act 2001 enacted by Govt. of India to promote, facilitate and enforce efficient use of energy has been made effective since ;
   (a) 1st March, 1999
   (b) 1st March, 2002
   (c) 1st March, 2010
   (d) 1st March, 2012
2. How many power distribution companies of Odisha are notified as Designated consumers and covered under Perform, Achieve & Trade (PAT) schemes for improving their distribution losses?
   (a) 3 (b) 5 (c) 1 (d) 4
3. What is the name of website run by the Bureau of Energy Efficiency to facilitate customers to search, compare & make informed choices before buying equipment such as refrigerators, air conditioners etc.?
   (a) beenet.gov.in
   (b) bee star label.com
   (c) beeindia.gov.in
   (d) bee net.com
4. The source of the Sun's energy is:
   (a) Nuclear fission reactions
   (b) Chemical reactions
   (c) Nuclear fusion reactions
   (d) Photoelectric effect
5. Which organisation of Odisha is the nodal agency for implementing energy efficiency and energy conservation provisions of the Energy Conservation Act 2001 in the State;
   (a) Odisha Renewable Energy Development Agency
   (b) Odisha State Pollution Control Board
   (c) Engineer-Chief (Electricity)-cum-Principal Chief Electrical Inspector
   (d) Odisha Power Generation Corporation Ltd.
6. About 30% of all incoming solar radiation is reflected back into space. This effect is known as;
   (a) Irradiance (b) Reflectivity
   (c) Albedo effect (c)Diffuse radiation
7. When sunlight falls on a photovoltaic panel, some particles gain enough energy to produce electric current. These particles are called;
   (a) Protons (b) Photons
   (c) Electrons (c) Neutrons
8. An on-grid solar photovoltaic power plant does not need to have a ;
   (a) Solar panel (b) Inverter
   (c) Battery (d) Power grid
9. Which among the following appliances can only be sold in India with BEE star label mandatorily fixed on it?
   (i) Electric geyser, (ii) Room air conditioner, (iii) Ceiling fan;
   (a) (i) and (ii) only (b) (i) only
   (c) (ii) only (d) (i), (ii) and (iii)

10. Which among the following, the Energy Conservation Building Code (ECBC) is applicable ? (i)Residential buildings, (ii) Commercial buildings, (iii) Buildings with connected load of 100 kW or greater;
(a) (i) only (b) (ii) only
(c) (iii) only (d) (ii) and (iii) only
11. Which of the following has an organic origin?
(a) Sand (b) Bakelite
(c) Nylon (d) Coal
12. Earth's atmosphere acts as a protective blanket for the living organisms to exist. Which of the following statement is/are true regarding the protective cover?
(a) It helps maintaining the temperature
(b) It absorbs the most harmful radiations from sun
(c) Both a & b
(d) None of the above
13. Where were photovoltaic cells first used to provide electricity?
(a) In satellites in space
(b) In cars
(c) In railway signals
(d) In village for lighting
14. Star labelling is provided by the Bureau of Energy Efficiency, Govt. of India & displayed on electrical home appliances such as refrigerator, TV, air conditioner. More stars indicate more of what ?
(a) Power (b) Voltage
(c) Current (d) Savings
15. Odisha Govt. holds majority stake in Odisha Power Generation Corporation owning a thermal power station. Where is the power plant located?
(a) Talcher (b) Ib vally
(c) Angul (d) Rengali
16. The equipment installed in power plants to reduce air pollution is;
(a) Induced draft fans
(b) De-super heaters
(c) Electrostatic precipitators
(d) Re-heaters
17. Super critical & Ultra-Super critical boilers are used in :
(a) Small coal power plants
(b) Small gas based power plants
(c) Large thermal power plants
(d) Large hydropower
18. At present, India's installed hydroelectric power capacity is ____ percent of its total power generation capacity.
(a) 13% (b) 35% (c) 45% (d) 60%
19. A device is fitted to motor vehicles to chemically reduce some gases like No_x, CO and hydrocarbons produced by internal combustion engines into less harmful products. This device is called ;
(a) Catalytic converter
(b) Stroke engines
(c) Carburettor
(c) Tail pipe
20. What is the term given to the solar designs used to heat interiors of buildings without using any electrical device?
(a) Passive solar design
(b) Active solar design
(c) Both passive and active solar design
(c) None of the above

ANSWER

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

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RECENT NEWS ON SCIENCE AND TECHNOLOGY

Largest Prime Number discovered

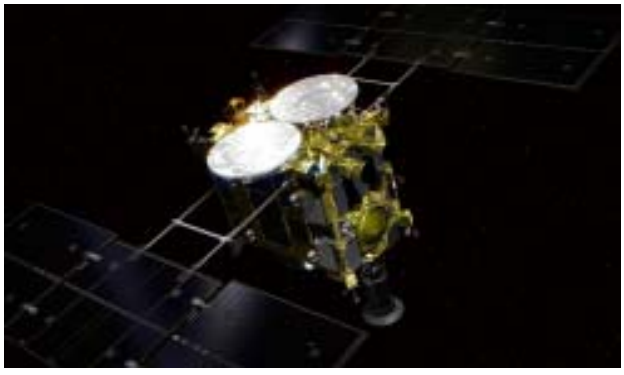
Prime number is a number which is only divided by 1 and itself. Greek mathematicians in 3rd Century BC had proved that there are infinity number of primes. But it is very difficult to discover large primes. Most of the large prime numbers are of Mersenne type. Large prime numbers are being searched worldwide by a project called the Great Internet Mersenne Prime Search (GIMPS). Mathematics enthusiasts throughout the world work on a computer program freely available from GIMPS. The largest prime member was discovered under the project in December 2018 by Patrick Laroche of USA. The number is, $[2^{82589933}-1]$ and it has 24862048 digits.

End of a successful space mission

NASA officially declared on 13 February 2019 that the Opportunity Mars Mission was complete. The solar panel of Opportunity was inactive almost eight months before it due to a raging dust storm and there was no communication with it. Opportunity was launched on 7 July 2003 and landed on Mars on 25 January 2004. Although it was planned to work for 90 days on Mars surface, it performed there almost 15 years. It was a solar-powered robot standing 1.5 m high, 2.3 m wide and 1.6 m long and weighing 180 kg. It moved on the surface with its six wheels with a maximum speed of 5 cm/s. It has traversed over 45 km on Mars surface covering many craters, hills and plane areas. It has provided substantial evidence of past water activity on Mars. In addition to this, it has also obtained astronomical observations and atmospheric data.

Samples from Asteroids

Hayabusa-2 spacecraft sent by Japan space agency JAXA landed momentarily on the asteroid 162173 Ryugu on 22 February 2019 and collected soil samples from its surface. Launched on 3 December 2014, the spacecraft reached the orbit of the asteroid on 17 June 2018. It had dropped four rovers on the surface of the asteroid and they are sending data on the asteroid. The spacecraft will again land on the asteroid twice to collect the



samples and return to the earth in December 2020. Scientists believe that they can get valuable data on the asteroid, particularly availability of ores, after analysing it.

India's Anti-Satellite Missile Test

On 27 March 2019, India conducted 'Mission Shakti', an anti-satellite missile (ASAT) test. This was a technological mission carried out by the Defence Research and Development Organisation (DRDO). During the test conducted from Abdul Kalam Island near Dhamara, India targeted one of its own satellites with a ground-based missile. The targeted satellite, Microsat-R was operating in a low orbit about 300 km high. This type of test requires an extremely high degree of precision and technical capability, which India demonstrated successfully. With this successful test, India became the fourth country to test an ASAT after the United States of America, Russia and China.

Abel Prize, 2019

On March 19, 2019, the Norwegian Academy of Science and Letters declared US mathematician Karen Keskulla Uhlenbeck as the winner of the 2019 Abel Prize.

Abel prize is named after the 19th century Norwegian mathematician Niels Henrik Abel. It was established in 2002 by the Government of Norway to honour people doing outstanding scientific work in the field of mathematics, a discipline not included among the Nobel awards. The prize is being awarded every year since 2003. Along with the Fields Medal, which is awarded every four years at the Congress of the International Mathematical Union (IMU), it is one of the world's most prestigious maths prizes.

Uhlenbeck's research has led to revolutionary advances at the intersection of mathematics and physics. Her pioneering insights have applications across a range of fascinating subjects, from string theory, which may help explain the nature of reality to the geometry at space-time. She developed tools and methods in global analysis, which are now in the tool box of every geometer and analyst. She is also a role model and a strong advocate for gender equality in science and mathematics. She is a professor emerita at the University of Texas at Austin, USA. She is also a visiting senior research scholar at Princeton University and a visiting associate at the Institute of Advanced Study. She is the first woman to receive the Abel Prize, which comes with a cheque for six million kroner (620,000 euros or $ 703,000).

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Compiled by
EDITOR

GUIDELINES FOR CONTRIBUTING ARTICLES FOR THE MAGAZINE

1. "SCIENCE HORIZON" aims at developing the scientific outlook of students as well as the general people and seeks to give them information on scientific developments. It is published as a monthly magazine.
2. The authors desirous of writing and contributing articles to the magazine should first assimilate the ideas of the theme and present it in simple language and popular style.
3. The authors are requested to write clearly on one side of A/4 size paper. The relevant pictures in 4cm X 6 cm size are welcome. Photo copies of manuscripts are not accepted for consideration.
4. Each article will be ordinarily of two to three printed pages in A/4 size papers.
5. The article shall be profusely illustrated with pictures.
6. At the end of the article the author should give the references and suggestions for further reading.
7. The reference of books, journals, sources, ideas and essential points collected by the writer should be mentioned in the bibliography. This will enhance the quality and fidelity of the writing and give the reader an opportunity for making further studies.
8. Matter translated from other languages and illustrations should indicate the original sources otherwise those would not be accepted. The articles which are not published, can not be returned to the authors.
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11. All units in the articles should be given in the metric system.
12. The title of the article should be brief and attractive. Moreover, subtitles may be given in long articles. The writings should be coherent and cohesive.
13. There should not be repetition of specific words. While ensuring the contemporary spirit of the writing, it should reflect some valuable lesson for the society. It is also necessary to avoid mistakes in spelling, language use and factual details.
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