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ARTICLES FOR SPECIAL ISSUE OF SCIENCE HORIZON

The special issue of Science Horizon will be published in the month of December 2024 on the theme "WATER IS LIFE". Authors are requested to send the articles on the above theme by 05.11.2024. The article should be written for the common people. The students should send the articles through the head of the Institution.

The topics may include:- CHEMISTRY OF WATER, WATER IN OUR BODY, WATER FOR PLANTS, SOURCES OF WATER, WATER CYCLE, WATER POLLUTION, WATER CONSERVATION, WATER HARVESTING, HYDROPOWER, OBTAINING CLEAN WATER FROM SEA, DIFFERENT USES OF WATER and any other topic related to water.

The articles should ordinarily be of maximum five pages, printed on one side of A4 size paper. The articles should be sent through e-mail : cesh.oba1@gmail.com or by post / by hand to the Secretary, Odisha Bigyan Academy, Plot No. B/2, Saheed Nagar, Bhubaneswar-751007, Odisha, India.

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CONTENTS

Editorial

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QUANTUM COMPUTER

We are now living in a digital age and computers are the backbone of this age. Although the computer was developed to do calculations, now a lot of works are being performed by it. It initially became popular due to its speed of calculation. Gradually its operating speed was increased and today we use supercomputers in such jobs as meteorology, medicine, space exploration, warfare etc. Today's fastest supercomputer works at 1.1 exaflops, meaning it can do 1.1 quintillion calculation in one second. These computers use transistors and other electronic computers which produce heat due to which thier capacity become limited. Now scientists are developing quantum computer whose capacity will be much more than the conventional computers.

Quantum computer works on the principle of quantum mechanics which has been developed in the second decade of the last century. Quantum mechanics deals with the behaviour of matter at atomic and subatomic level. A quantum computer differs from a conventional computer in that it does not use transistor. The conventional computer requires data to be encoded into binary bits, each of which can have only the value of 0 or 1. The fundamental difference in a quantum computer is that it is not limited by these two options. Quantum bits (qubits) can exist as 0 and 1; as a point anywhere in between; or as both 0 and 1 simultaneously utilising the principle of quantum superposition. Superposition is the state in which a quantum particle or system can represent not just one possibility, but a combination of multiple possibilities. In other words, the simultaneous existence of multiple possible values of a property is called superposition. As electrons or photons have also wave properties, they can take multiple positions simultaneously.

A conventional computer only works on one computation at a time and hence its speed can be increased only by making multiple components work on separate tasks simultaneously. But due to superposition, a quantum computer will have the ability to work on a billion computations at once. A large quantum computer can in theory solve computational problems unsolvable by a classical computer in any reasonable amount of time.

The first Pentium II computers could perform 100 million floating point operations

per second. The GPUs have a capability of 20 trillion operations and TPUs (densor processing units) are capable of 180 trillion floating point operations. But all these seem to pale in comparison to the quantum computer. If scientists become successful with 72-qubit prototype to which they are now working, its computing ability would be equal to that of millions of conventional computers. A 333-qubit quantum computer would offer $(10)^{99}$ operations. In 2019, Google AI and NASA announced that they had achieved quantum supremacy with a 54-qubit machine.

In July 2024, quantum computing company Quantinuum announced that their new 56-qubit H2-1 computer has broken world record in quantum supremacy. Quantum supremacy is a term that describes the engineering feat of demonstrating that a programmable quantum device can solve a problem beyond the capabilities of the classical computers.

This extra high value is due to the quantum entanglement which is another feature of quantum mechanics. It is a phenomenon that explains how two subatomic particles can be intimately linked to each other even if separated by billions of light-years of space. Despite their vast separation, a change induced in one will affect the other.

Let us see how it works in quantum computer. When we measure one qubit, it chooses one value. But it also gives us the value of the other qubit to which it is correlated. If we will add more qubits to the system, these correlations get complicated and start growing exponentially. 2 qubits can give 4, 3 qubits can give 8 and thus it continues. For 'n' qubits, there are 2^n correlations.

Satya Nadella of Microsoft compares both the computers with the example of a maze. If a conventional computer has to figure a way out of a maze, it will approach the maze the traditional way-start down one path, hit an obstacle, backtrack and then startdown the next. Keep at it until it finally finds the right path. But a quantum computer would approach every path in the maze simultaneously. That is the power of quantum!

Quantum processor is the brain of the quantum computer. As a core component, it contains the system's physical qubits and the structures required to hold them in place. Qubits are made using physical systems, such as the spin of an electron or the orientation of a photon. Quantum processing units (QPUs) include the quantum chip, control electronics and classical computer hardware required for input and output. Quantum processors need to be very cold – about a hundredth of a degree above absolute zero – to minimise noise and avoid decoherence to retain their quantum states (Decoherence is a process in which a system in a quantum state collapses into a non-quantum state). This ultra-low temperature is achieved with supercooled superfluids. At this temperature some metals exhibit the property of superconductivity (no resistances).

Quantum computers are now in experimental stage. It will take some time for full development.

Er. Mayadhar Swain
Editor

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STORY OF THE ELECTRON (PART-11)

[1]Balaram Sahoo
[2]Prafulla Kumar Pujapanda

PAM Dirac was an English mathematical and theoretical physicist who laid the foundation of quantum mechanics in 1925 and in the year 1928 founded the relativistic quantum theory. His derivation gave solutions that he interpreted as being caused by a particle equivalent to electron but opposite in charge which was later confirmed by experiment by C. D. Anderson in 1932. He was the Lucasian professor of mathematics at the Cambridge University and won Nobel Prize in physics in the year 1933 along with Erwin Schrodinger.

……..

Paul Adrien Maurice Dirac (1902-1984) was born on 8th August 1902 at Bristol, England. His father Charles Adrien Ladislas Dirac was a French speaking Swiss, worked at Bristol as a French teacher. His mother Florence Hannah Dirac was English and worked as a librarian at Bristol central library. Paul was second of the three siblings of his parents. Charles and his three children were officially Swiss till they were naturalized on 22 October 1919. His father was an overbearing and authoritarian personality and imposed that all his three children must speak with him in French so that they be able to learn the language. Dirac being unable to express himself in French most of the time remained silent. This had a lasting effect on Paul and made him a man of few words and an introvert.

Education

Dirac was first admitted to Bristol Road Primary School and later joined All Boys Merchant Ventures Technical College which was attached to Bristol University. On the advice of his father he studied Electrical Engineering and completed his degree in 1921 with first class Honors.

He sat for an entrance examination for St. John's College, Cambridge and qualified with a scholarship of 70 pounds that was inadequate to live and study at Cambridge.

Paul Dirac (1902-1984)

Despite having a First Class Honors he was unable to find a job. He offered to study mathematics at the University of Bristol.

Dirac considered Peter Fraser the best mathematics teacher, learnt from him 'Projective Geometry' and applied it into the Geometrical version of relativity, developed by Minkowski.

In 1923, Dirac graduated with a First Class Honors and was awarded a scholarship of 140 pounds from the department of scientific and industrial research which was adequate to live at Cambridge.

Contribution to Quantum Mechanics

Dirac pursued with great interest Albert Einstein's general theory of relativity which had created a storm in the year 1919 in mass media, and had a thorough understanding of the important aspects of the theory. But his knowledge in atomic science was feeble and he attached no importance to it. After arriving in Cambridge he changed his mind.

Bohr had been in Cambridge in 1925 to lecture on the problems of quantum theory. It was the first meeting of Dirac with Bohr. He was highly impressed by Bohr's presentation in measured words and arguments. But Bohr's statements, its clarity of expression were poised with ideas but not backed by mathematical equations. Soon Heisenberg arrived from Gottingen to give a lecture on quantum mechanics at Cambridge after spending months in Copenhagen, Gottingen and the island of Helgoland to express Bohr's ideas in mathematical expressions. Though Dirac was in audience he exhibited no interest as most part of the lecture was on atomic spectroscopy. Towards the end, however, Heisenberg gave a brief outline of his work that he was pursuing. But that too was not clear to Dirac.

Ralph Howard Fowler
(1889-1944)

Heisenberg was the house guest of Ralph Fowler, son-in-law of Rutherford and Dirac's research guide while in Cambridge and discussed with him his latest ideas on quantum mechanics yet to be published. Being asked for a proof copy of the paper, Fowler had it within a few days. Having little time to study it with thoroughness, Fowler handed over the paper to Dirac asking for his critical examination and opinion. It was the month of September, 1925. Dirac found it difficult to follow. He could not appreciate the main ideas of the breakthrough. After about a week Dirac while walking in the country side of Cambridge, could suddenly remember his earlier mathematical lessons on matrices and recollected the non-commutability of A x B and B x A which was at the heart of the problem. The mysteries of Heisenberg's key ideas were now clear to Dirac.

Dirac proceeded to establish a mathematical theory that led him to derive the

formula **PQ – QP =** $i\frac{h}{2\pi}I$**, as found by the Gottingen school** on distinguishing the numerical observable quantities x and y that commute and those that don't commute. The key to the problem that quantum mechanics was different from classical mechanics that the variables position P and momentum Q do not commute. He published his landmark work with the title "The Fundamental Equations of Quantum Mechanics" in the Proceedings of Royal Society. He received his PhD on the subject 'Quantum Mechanics in 1926 from the University of Cambridge.

Dirac became the Lucasian professor of mathematics in the University of Cambridge in 1927 and retired in 1963. In 1937 he married the physicist Eugene Wigner's sister Margit Wigner of Budapest a divorcee with two children whom Dirac looked after like his own. Paul and Margit Dirac also had two daughters, Mary Elizabeth and Florence Monica.

He was awarded Nobel Prize in the year 1933 with Erwin Schrodinger. He was the youngest ever theoretician to win the Nobel Prize until T.D Lee in 1957. His notable work "The Principle of Quantum Mechanics" published in 1930 is still one of the best books of quantum mechanics.

Other fundamental Contributions

Dirac stands out as one of the greatest figures for his fundamental contributions in early development of both quantum mechanics and quantum electrodynamics. In 1928, he formulated Dirac equation that described the behavior of fermions and predicted the existence of anti-matter. His equation is regarded as the most important equation in physics and in opinion of some it represents the seed of physics.

He has made significant contributions reconciling General Relativity and Quantum mechanics, cosmology and String Theory.

During war years he made fundamental contributions to process uranium enrichment and gas centrifuge.

Anecdotes

There are many amusing anecdotes concerning Dirac which are recounted even today. A few are quoted here.

Once Neils Bohr while writing papers complained that he did not know how to finish the sentence he was writing. Dirac replied 'I was taught at school never to start a sentence before you know its ending.'

Once Margit Wigner told both George Gamow and Anton Capri in 1960 that once her husband had said to some home visitors "Allow me to present Wigner's sister who is now my wife."

Another story told about Dirac is that when he met young Richard Feynman at a conference he said after long silence, 'I have an equation; do you have one too?'

Heisenberg, Born and Dirac made a deep impression on all theoretical physicists. In the beginning of 1926, the Austrian physicist, Erwin Schrodinger provided a new version of quantum mechanics which brought a new revolution in the theoretical world physics.

To continue…

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ELEGANT EQUATION-I
$E=mc^2$

Er. Mayadhar Swain

Einstein's equation $E = mc^2$ is the most well known equation, yet so simple and elegant. In words it is, "energy is equal to the mass multiplied by the speed of the light squared." This mass-energy equation is a consequence of Einstein's Theory of Special Relativity published in 1905. For centuries, scientists believed that energy and mass were two entirely separate things. Einstein ((1879-1955) showed that these two were one. In other words, mass and energy are just different forms of the same things. This means that mass can be converted into energy and energy can change into mass.

To appreciate the significance of $E=mc^2$, consider the following: E is energy in joules, m is mass in kilograms and c is the speed of light in metres per second. Value of c is about 300,000,000 metre per second. Thus, the energy released by 1 kilogram of matter

= 1 x 300,000,000 x 300,000,000 joules

= 90,000 million million joules

= Energy released by 20,000 of TNT

The Hiroshima atomic bomb was only a 15 kiloton bomb. For years Einstein believed that energy could not be released from mass practically. But in 1938, radiochemists Otto Hahn and Fritz Strassmann along with physicist Lise Meitner, while bombarding uranium with neutrons in their Berlin laboratory made the unexpected discovery of nuclear fission. The uranium atom, after bombardments split into two lighter elements krypton and barium. It is found that the total mass of the two product elements krypton and barium is slightly less than the mass of the uranium atom. This lost mass is converted to energy as per Einstein's equation.

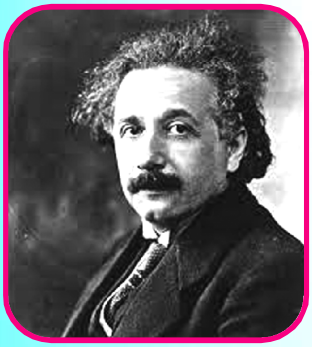
$$ {}^{1}_{0}n + {}^{235}_{92}U \rightarrow {}^{141}_{56}Ba + {}^{92}_{36}Kr + 3\,{}^{1}_{0}n + \text{Energy} $$

The first two atomic bombs were made using this principle and were dropped in Hiroshima and Nagasaki of Japan in 1945. Now many countries have nuclear bombs in their arsenals. Further, using this principle, electricity is being generated from many nuclear reactors in the world. We can say that, $E = mc^2$ ushered in the atomic age.

For Einstein to be able to see that energy and mass are two sides of the same coin and to

ALBERT EINSTEIN

Albert Einstein is the most influential scientist of the 20th century. He was born on March 14, 1879, in Ulm, Germany. The family moved to Munich shortly after his birth and later to Italy when his father faced problems with running his own business. He graduated from the federal polytechnic school Zürich, Switzerland in 1900. However, he could not find a teaching position, and began work in a patent office at Bern in 1901. It was there that he developed his work in special relativity and other areas of physics that later made him famous.



Einstein earned his doctorate from the University of Zurich in 1905 and subsequently took on professor positions in Zurich (1909), Prague (1911) and Zurich again (1912). Next, he moved to Berlin to become Director of the Kaiser Wilhelm Physical Institute and a Professor at the University of Berlin (1914).After the rise of Nazi power in Germany, he migrated to the USA in 1933 and worked as professor of theoretical physics at the Institute for Advanced Study, Princeton until his death in 1955.

Four papers on - the photoelectric effect, brownian motion, special theory of relativity and the equivalence of mass and energy- published in 1905 made him famous in the world of physics. In 1915, he published his General Theory of Relativity which changed the idea of Newton's gravity. After verification of this work by Sir Arthur Eddington, secretary of the Royal Astronomical Society, during a total solar eclipse in 1919 made him famous worldwide. His contribution to the quantum mechanics and Unified Field Theory is also noteworthy. He received the 1921 Nobel Prize in Physics "for his services to theoretical physics, and especially for his discovery of the law of the photoelectric effect".

Einstein married Mileva Maric, a long time love of his from Zurich, in 1903. Their children, Hans Albert and Eduard, were born in 1904 and 1910. He divorced Maric in 1919 and soon after married Elsa Löwenthal. Löwenthal died in 1933.

then use mathematics to express this fact in such a simple form is definitely an intellectual marvel.

Extension of The Equation for Systems in Motion

Einstein's equation $E = mc^2$ is for the rest mass, but when the mass is in motion, the total energy of the system depends on both the rest mass and the total momentum of the system. It is given by,

$$E = \sqrt{(mc^2)^2 + (pc)^2}$$

where p is the momentum. When the mass is at rest, momentum (p) is zero and hence the equation becomes same as that of Einstein's mass energy equation.

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THE PROGRESS AND NAMING OF SI UNIT PREFIXES

Dr. Mridula Mishra

Introduction

The only system of measurement units accepted globally is the International System of Units, briefly known as SI. For each measurement a standard is chosen. Every measuring instrument must be compared with that standard. The present measurement system, which is accepted world over has its origin in the time of French Revolution. Any quantity which can be measured is called a physical quantity. There are seven fundamental or base physical quantities namely- length, mass, time, electric current, temperature, luminous intensity, and amount of substance in terms of which other physical quantities can be measured. In the process of measurement, the accepted reference standard which is used for comparison of a given quantity is called a unit. Officials from seventeen nations came to an agreement on the International System of Units at the Metre Convention on 20th May 1875 in Paris. The treaty created the 'International Bureau of Weights and Measures (BIPM)' under the authority of the 'General Conference on Weights and Measures (CGPM)' and the supervision of the 'International Committee for Weights and Measures (CIPM)'. An attempt was made to eliminate disparities and achieve uniformity in global measuring system. In the year 1967, CGPM rationalized the MKSA (metre, kilogram, second, ampere) system of units and adopted a system based on six base units. It was called the 'Systeme Internationale de unites' in French and known as SI units in all languages. In 1971, the General Conference added another base unit to the SI units i.e., 'mole' for the 'Amount of substance'. Hence the SI units have seven base units for seven physical quantities and are commonly used for all scientific and technological purposes. From these seven base quantities, twenty-two derived units are defined with unique names and symbols.

Ancient Measurement Systems

Measurement is a basic activity in every day human life. Starting from simple measurements like weighing of edible products by shop keeper, measuring field by farmer, measuring the cloth before tailoring by tailor to more sophisticated measurements including navigation, air and water quality, pharmaceutical efficacy, disease diagnosis and detection etc. is essential for various scientific and technological advancements in modern human civilization. There were different

measurement systems prevailed in different parts of the world in ancient times. Different literature reveals that China, Egypt, India all appear to have used a variety of early measurement systems. The 'cubit', a wooden rod used to establish normative length and heights was developed by ancient Egyptians and is commonly accepted as the oldest measurement unit. It was used to measure the flood water levels of Nile River and in construction of pyramids. Similarly, the 'mina' is considered as first weight unit. The Babylonians established it. In Indian measurement system, during the Chandragupta Maurya period, the smallest unit of length was 1 'Parmanu'. Small lengths were measured in 'anguls'. For long distances 'Yojana' was used. In the medieval period the unit of length was 'gaz'. This was extensively used to measure land pieces for construction of houses, well, gardens and roads. The 'gaz' was widely used as a unit of length till the metric system was introduced in 1956. During British period the inch, foot, and yard were used to measure length whereas grain, ounce, pounds etc. were used to measure mass. Again, the goldsmiths and practitioner of traditional medicine system in India used 'Ratti', 'Masha', 'Tola' etc. as units of mass.With passage of time, the need for measurement standardization was felt to bring about a worldwide uniformity in measuring system and consequently above-mentioned SI units developed.

SI unit Prefixes and its Progress

SI prefixes have been introduced to form multiples and submultiples. Prefixes have been used since the French revolution when metric system was first initiated. A small range of orders of magnitude between 0.001 and 1000 had been covered in 1795. This had an impact on the first set of recommendations made by CIPM in 1879. We all have used and remembered these prefixes from our school days. These are milli(m), centi(c), deci(d) in sub-multiples and Deca(da), Hecto(h), kilo(k) in multiples. Mega(M) and micro(μ) were first introduced as prefixes in the year 1935 but were fully resolved with other prefixes in 1960. The prefixes added in 1960 were mega (M), giga (G), and tera (T) for multiples and micro (μ), nano (n), and pico (p) for submultiples. Then in 1964 two more prefixes- femto (f) and atto (a) were added for forming submultiples. This created an imbalanced situation, where there were more prefixes for small quantities. Hence, two more prefixes- peta (P) and exa (E) were added for forming multiples. In 1991, four more prefixes were added, zetta (Z), yotta (Y) for multiples and zepto (z), yocto (y) for submultiples.

The range of SI prefixes must be expanded when scientific advancements required access to a wider range of orders of magnitude in measurement process. Modern computing of present day has led to an increase in the usage of SI prefixes in data science. The size, cost, and speed of digital storage all increase with each passing years in accordance with Moore's law or beyond. There has been a lot of interest in what should happen next as the growing needs of science and computing and the increasing amount of on-line data continue to increase exponentially. To tackle

this problem, the international scientific community agreed to expand the number of prefixes use within SI at the 27th CGPM in 22nd November 2022. After a gap of almost thirty years, four new prefixes were added, two for forming multiples- ronna (R), quetta (Q)and two for forming submultiples- ronto (r) and quecto (q) thus making the total number of prefixes 24 for use. SI prefixes for submultiples are formatted with lowercase symbols while prefixes for multiples use uppercase symbols with the exceptions of three: kilo (k), hector (h) and deka (da).The list of latest SI prefixes is given below.

Name	Symbol	Factor	Name	Symbol	Factor
quetta	Q	10^{30}	quecto	q	10^{-30}
ronna	R	10^{27}	ronto	r	10^{-27}
yotta	Y	10^{24}	yocto	y	10^{-24}
zetta	Z	10^{21}	zepto	z	10^{-21}
exa	E	10^{18}	atto	a	10^{-18}
peta	P	10^{15}	femto	f	10^{-15}
tera	T	10^{12}	pico	p	10^{-12}
giga	G	10^{9}	nano	n	10^{-9}
mega	M	10^{6}	micro	μ	10^{-6}
kilo	k	10^{3}	milli	m	10^{-3}
hector	h	10^{2}	centi	c	10^{-2}
deca	da	10^{1}	deci	d	10^{-1}

Naming of SI unit Prefixes

Naming of SI unit Prefixes

The names for most of the prefixes were originated from numerals either in Latin or Greek languages. For example, kilo is "thousand", hector is "hundred", and deca is "ten" in Greek. And deci, centi and milli are respectively "tenth","hundredth" and "thousandth" in Latin. Naming of some initial prefixes for multiples and submultiples were also selected from Latin and Greek words meaning large and small respectively. For example, meaning of tera is "monster", giga is "giant", mega is "big" in Greek. Similarly, micro and nano are used for "small" and "dwarf" in Greek respectively. In Spanish meaning of pico is "tiny bit". Afterwards some norms were followed for selecting the names of prefixes. Starting letters of new prefixes must not be same as beginning letters of existing prefixes or units. Additionally, prefixes for multiples and submultiples should end with letter "a" and "o" respectively. Following these norms the naming of the prefixes ronna, ronto and quetta, quecto were made.The prefixes ronna and ronto are formed by combining the letter "r" with Greek letter "ennea", representing the number nine and the standard SI suffixes "a" for large numbers and "o" for small numbers. The number nine relates to the fact that ronna and ronto are $(1000)^{9}$ and $(1000)^{-9}$ respectively. Similarly, the origins of prefixes quetta and quecto are combination of the letter "q" with Latin numeral "decem" for number ten and standard SI suffix "a" and "o" respectively. The number ten relates to the fact that quetta and quecto are $(1000)^{10}$ and $(1000)^{-10}$ respectively.

Conclusion

The latest four prefixes opened the possibilities for precise and efficient quantification across various scientific and technological domains for extremely large numbers like volume of data stored on servers for the Internet to extremely small numbers, used in quantum physics etc.

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5

DOUBLING THE CUBE

Santosh Kumar Nayak

Geometry is an ancient subject on the dawn of civilisation. It was the main subject, to which great minds of that era were attracted. They saw the nature & realised symmetry. After growth, geometry was restricted to Euclidean geometry only, actually without restriction it would be unbounded, open and huge & tedious to study and understand. An important part of Euclidean geometry is geometrical construction on a plane, to avoid unnecessary complication. Euclid restricts to use only a straight edge and a compass. This restriction although prevented unnecessary things, but also prevents us from some splendour of geometry. In other words, we can't construct many geometrical figure with this restriction e.g.

i) Construction of helical spiral.

ii) Construction of sine curve.

iii). Construction of ellipse & parabola and many more.

But historically three famous problems were headache for Greeks. The three problems are;

a) Doubling the cube

b) Squaring a circle

c) Trisecting an angle.

Here we discuss only how to double a given cube. The problem is to construct a cube which has double volume to another smaller cube.

Consider a small cube having length of edge "a" then the volume of cube is a^3. Now, what will be the length of edge of the cube whose volume is $2a^3$? The answer is very simple for a high school student, that the edge will $(2)^{1/3}a$, but real problem is how to construct $(2)^{1/3}a$, on real number line.

So the "doubling the cube" problem is nothing but how to construct $(2)^{1/3}a$. This is not possible by straight edge (scale) and compass only. The proof of impossibility is by contradiction method and which needs deep knowledge of field theory. We should avoid to be analytical and think how to solve the "doubling the cube" problem.

The solution was given by Italian mathematician Mascheroni (1750-1800). He made an instrument. By this instrument, we can construct the length of $(2)^{1/3}a$, so this is the violation of ruler (straight edge) and compass by using a Mascheroni's instrument (which consists of four parts)

1. A metallic right angle having linear cuts.
2. A cross bar at right angles &
3. Two supporting wooden thin rectangular, bars.

The diagram of the Mascheroni's instrument is given in Fig.1.

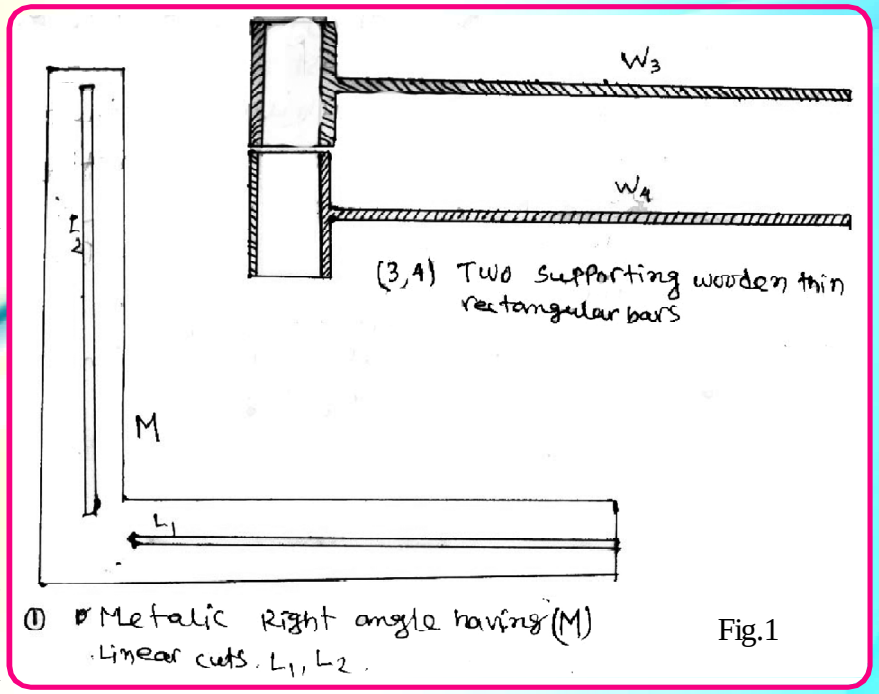

Fig.1

Now for $(2)^{1/3}a$, construction, choose P on BX arm of cross bar and chose Q point on BY arm of cross bar such that 2BP = BQ. Then

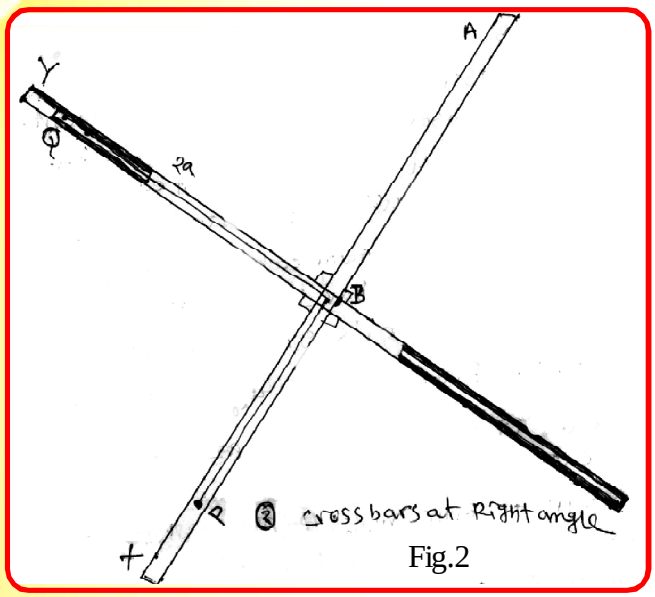

Fig.2

adjust the crossbars on metallic right angle M in such a manner that Q is on L_2 and P is on L_1. Then W_3 supporting wooden bar is adjusted perpendicularly on L_2 at Q, then let W_3 touches BA arm of cross bar B, at D. Now adjust W_4 perpendicularly from D to metallic Right angle which intersect L_1 at G. The whole arrangement is like the following figure (3).

The figure-4 is schematic representation of figure-3.

Deduction: by angle - angle similarity axiom. Triangle PBG is similar to DBG. Triangle, so

$$\frac{a}{x}=\frac{x}{y} \quad \ldots\ldots\ldots\ldots\ldots (1)$$

Again triangle DBG is similar to QBD so

$$\frac{x}{y}=\frac{y}{2a} \quad \ldots\ldots\ldots\ldots\ldots (2)$$

By equation (1)&(2) we have $\frac{a}{x}=\frac{x}{y}=\frac{y}{2a}=K$ (let)

Then $a = kx$	or $a = k^2y$	or $K = \frac{1}{(2)1/3}$
$x = ky$	or $a = 2ak^3$	
$y = 2ak$	or $k^3 = \frac{1}{2}$	
Now $a = \frac{x}{(2)1/3}$	or $x = (2)^{1/3}a$	

Measure x by compass then plot on real

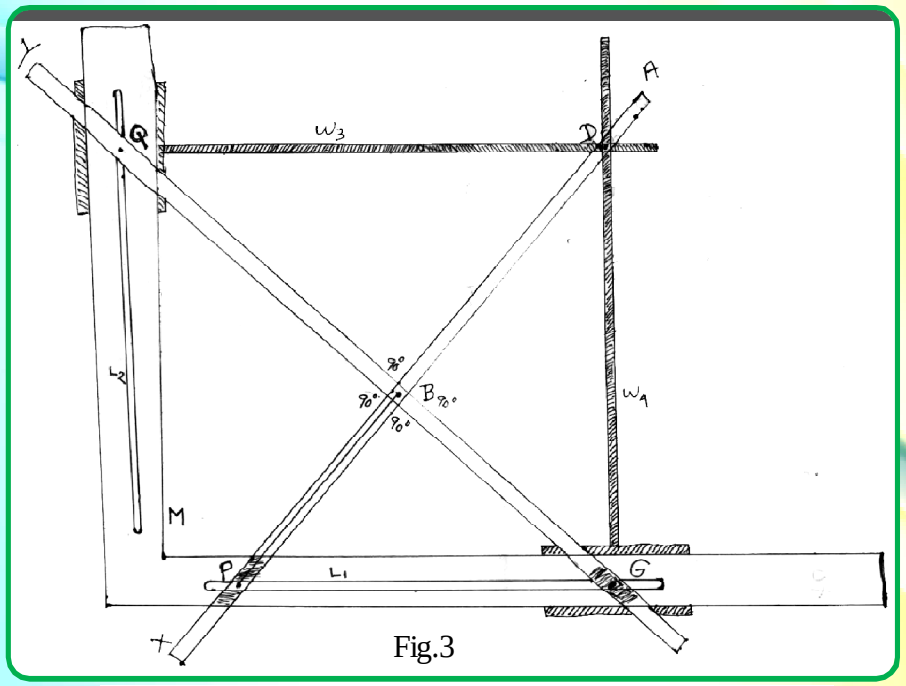

Fig.3

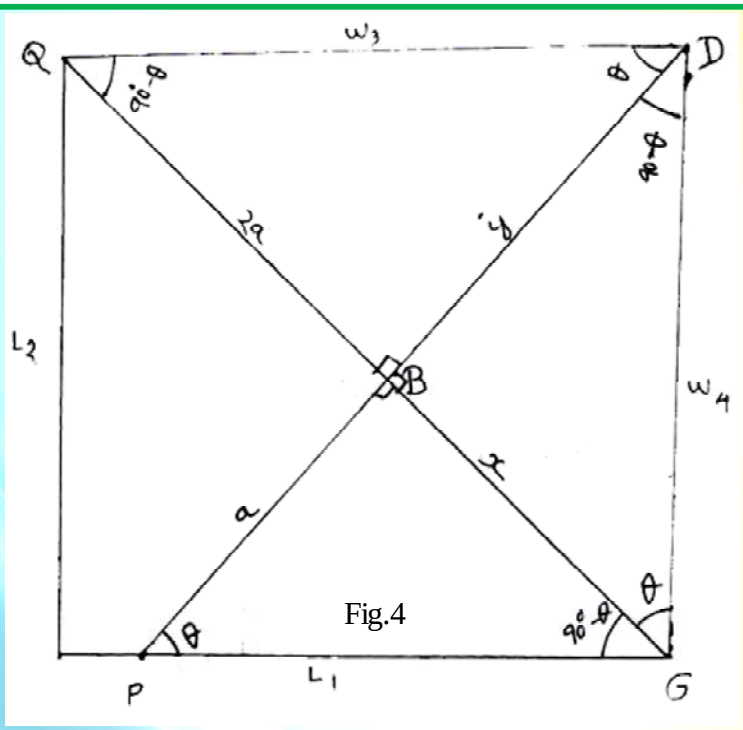

Fig.4

Number Line.

This is your $(2)^{1/3}$a length of edge to doubling the cone.

Teacher In A Private Institution
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6 ARTIFICIAL INTELLIGENCE: WHAT, WHY AND HOW

Abhipsa Dash

What is AI?

Artificial Intelligence (AI) refers to machines or computer systems that are designed to perform tasks that typically require human intelligence. These tasks include learning from experience, pattern recognition, and making *decisions based on that information*. At the heart of AI are algorithms, which are sets of instructions that tell computers how to perform specific tasks. These algorithms are trained using vast amounts of data, allowing them to learn and improve over time. One common form of AI is machine learning, where algorithms learn from data without being explicitly programmed.

The term "artificial intelligence" was coined in 1956 during the Dartmouth Conference, organized by John McCarthy, Marvin Minsky, Claude Shannon, and Nathaniel Rochester. This event marks the birth of AI as a field of study. While the formal concept of artificial intelligence emerged in the mid-20th century with digital computers, its roots trace back to myths and legends from ancient civilizations,

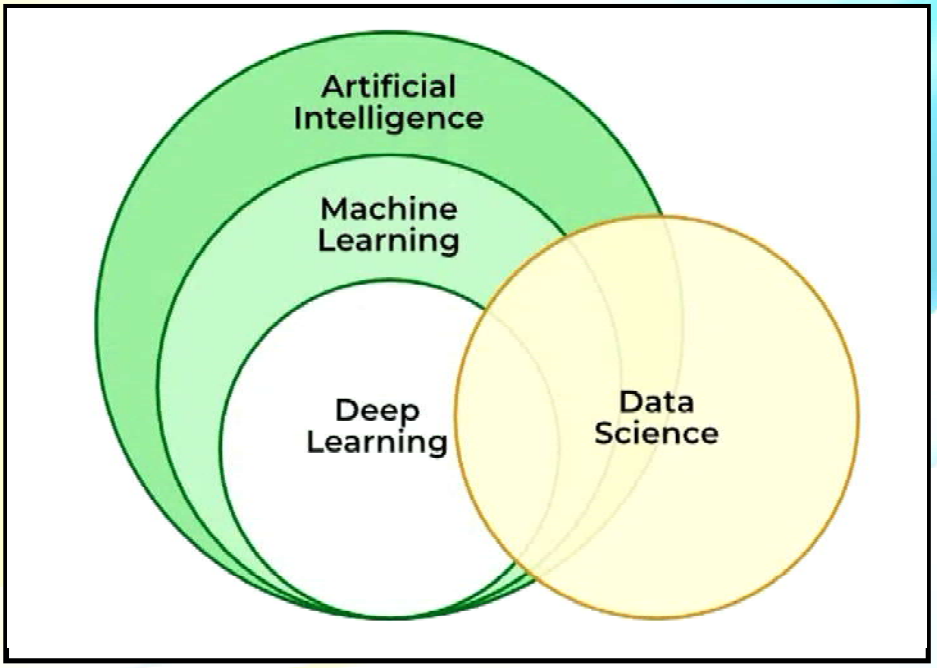

Fig. 1: Conceptual Diagram of AI, Machine Learning, Deep Learning, and Data Science

such as the Greek myth of Talos, a giant automaton.

Branches of AI

Artificial Intelligence encompasses diverse subfields, each dedicated to different elements of developing intelligent systems:

■ **Machine Learning:** This branch focuses on developing algorithms that allow computers to learn from available data in order to make predictions or decisions. It includes:

- **Supervised Learning:** It involves training models on labelled data to predict outputs for unknown data. Data is typically divided into training and test sets, often in an 80:20 ratio. The model is trained on the training set and evaluated using the test data to avoid overfitting.
- **Unsupervised Learning:** It involves analyzing and clustering unlabelled data to find hidden patterns or intrinsic structures. Some of the techniques involved in unsupervised learning include clustering (e.g., K-means, hierarchical clustering) and dimensionality reduction (e.g., PCA, t-SNE).
- **Reinforcement Learning:** This involves training models using a reward feedback system. After each action, the algorithm receives feedback indicating whether its choice was correct, neutral, or incorrect, and it aims to maximize rewards.

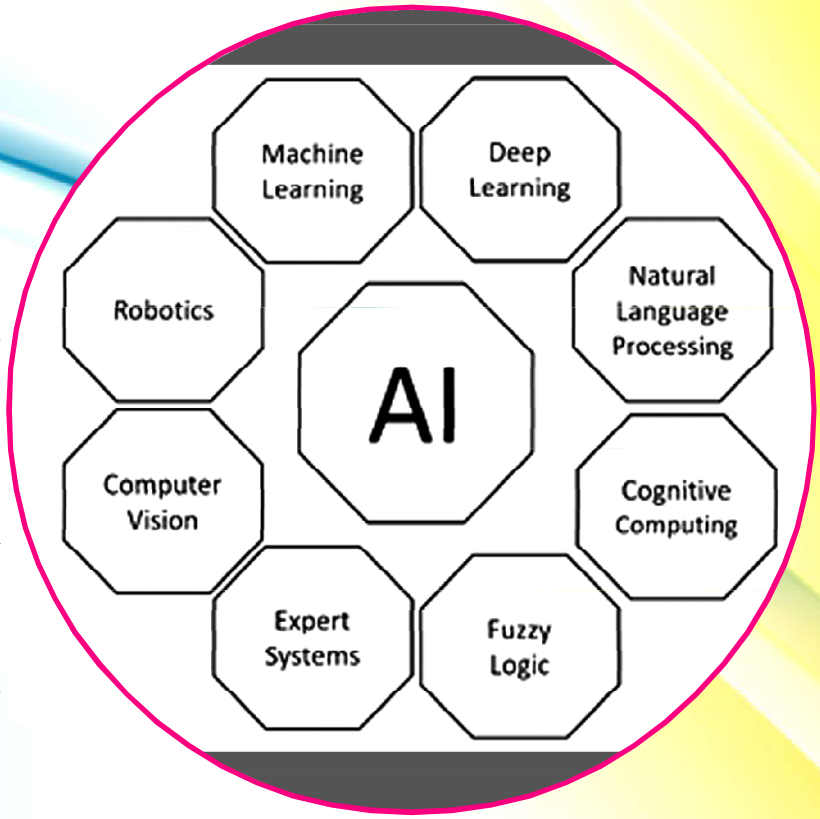

Fig. 2: Branches of AI

■ **Deep Learning:** This is a specialized subfield of machine learning *that uses multi-layered neural networks to model and understand complex patterns in data. Neural networks are inspired by the structure and function of the human brain.*

■ **Natural Language Processing (NLP):** This field deals with the interaction between computers and human language, enabling machines to comprehend, interpret, and produce human language.

■ **Computer Vision:** This enables machines to interpret and understand visual information, including image and video analysis.

■ **Expert Systems:**These systems emulate the decision-making abilities of human experts within specific domains, and are used in areas requiring high expertise such as medical

diagnosis, financial analysis, or complex engineering problems.

Recent advancements include Open AI's DALL-E, an AI model generating images from textual descriptions (2021), and Deep Mind's Alpha Fold, solving the protein folding problem (2022), demonstrating AI's potential in biological and medical research. AI technologies, including virtual assistants (such as Siri and Alexa), recommendation systems (like those used by Netflix and Amazon), and autonomous vehicles, have become ubiquitous in daily life.

Impact of AI in Daily Life

AI has the potential to revolutionize numerous aspects of life by automating repetitive tasks, enhancing efficiency and productivity, and analyzing vast amounts of data to identify patterns and trends that the human eye might miss. This leads to better-informed decisions in domains like healthcare, finance, and marketing.

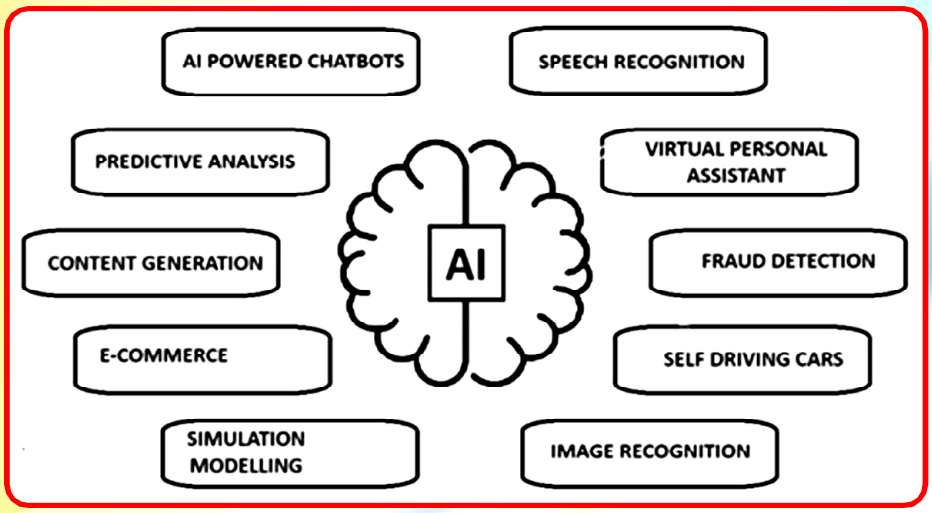

Fig. 3: Applications of AI in various domains

E-commerce platforms like Amazon and Netflix use recommendation systems, which leverage user browsing and purchase history to offer personalized recommendations, thereby enhancing user experience and driving sales.The COVID-19 pandemic accelerated the adoption of AI in healthcare for diagnosis, treatment recommendations, and vaccine development. *By analyzing medical images like X-rays and MRIs, AI algorithms can detect* subtle details that may escape human observation, *leading to earlier detection of underlying conditions and better outcomes for patients. In the transportation sector, AI is paving the way for self-driving cars that can navigate roads safely and efficiently* using sensors, cameras, and algorithms to perceive surroundings and make decisions to avoid obstacles and other vehicles.

AI-driven educational platforms adapt learning materials and pace based on students' strengths and weaknesses, fostering personalized learning experiences that cater to individual needs. In agriculture, AI-powered systems optimize planting schedules and irrigation by analyzing soil conditions, weather patterns, and crop health, while drones and cameras detect pests and diseases early. AI optimizes smart grids and predicts renewable energy outputs to balance supply and demand. Travel planning is personalized by

AI-driven platforms that recommend itineraries based on user preferences, and AI chatbots provide 24/7 customer support for bookings and travel assistance. From agriculture to legal services, AI is becoming an indispensable tool that is reshaping industries and improving our daily lives.

Future of AI

The future of AI is poised for remarkable advancements, driven by ongoing research,technological innovations, and integration into diverse sectors. While current AI systems are specialized in specific tasks, *the goal of* achieving Artificial General Intelligence (AGI), systems that exhibit cognitive abilities similar to those of humans spanning a wide spectrum of tasks, remains a significant focus.

The future will see more seamless integration of AI into human workflows, enhancing productivity and decision-making. AI systems will act as intelligent assistants, augmenting human capabilities in various domains such as research, education, and business. Advanced AI models can play a crucial role in addressing climate change and promoting sustainability by improving climate predictions, optimizing energy usage, and enhancing resource management. In healthcare, AI-driven systems will improve disease detection, treatment plans, and patient monitoring. Integration of AI with medical devices and wearables will facilitate real-time health data analysis, leading to proactive healthcare management. Autonomous systems, including self-driving cars, drones, and robotic assistants, will become more sophisticated and reliable.

Conclusion

Artificial Intelligence is not just a buzzword or a futuristic concept—it's a reality that's already shaping the world. From enhancing healthcare outcomes to optimizing online shopping experiences, AI holds the potential to revolutionize every facet of life.

However, advancements in AI call for careful consideration of their ethical, social, and economic implications. Research in the domain of Explainable AI (XAI) aims to enhance understanding of the decision-making procedure of AI, fostering trust and accountability. Developing robust frameworks for ethical AI deployment is crucial, addressing issues such as bias, privacy, and fairness to maximize benefits while minimizing risks. As AI continues to evolve, it's vital to navigate its ethical complexities and ensure its responsible use, promoting fairness and societal benefits while mitigating potential risks.

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7 ARE WE READY TO COLONIZE THE MOON

Nikunja Bihari Sahu

The Moon is the nearest celestial member to our Earth located at a distance of 3.84 lakh km distance away from us. Light takes only 1.2 seconds time to reach our Earth from the Moon in contrast to 8.3 minutes time in reaching us from the Sun. Man has long cherished to fly to the Moon with a flying machine and to build his home there. What started as a poet's naive curiosity ,has now become a fast reality because of the changing scenario of an increasingly competitive life on the Earth.

Moon

Our planet Earth has now lost its glory due to man's over exploitation of its resources since the Industrial Revolution of the late eighteenth century. It is estimated that Earth's fossil fuel reserve including coal, petroleum and natural gas will last only upto 50 years. Further, due to our high carbon footprints and a high rate of emission of greenhouse gases , global warming is taking place at an alarmingly faster rate resulting in drastic climate change and various environmental disasters. This summer, temperatures around the world have soared to unprecedented levels with temperature at some places reaching beyond 50 deg C. The sea level has been constantly on the rise and most of the island nations are under threat of submergence under the surging seas. If the present trend continues, a day will come when our charming Earth will no longer be suitable for sustaining life. Hence, a necessity has now come to search for a new celestial abode where we can migrate in case of a catastrophe happening in our planet. The Moon, being our nearest celestial neighbour, holds a promise and will be our first destination in our goal for searching such an abode in space.

However, conditions on the Moon are not favourable for life to flourish unlike on our Earth. There are several obstacles in this

direction. Firstly, it has no air and water, the prime requirements for life to exist on any planet. Secondly, it is constantly exposed to the harmful ultraviolet rays coming from outer space. Thirdly, Moon's soil lacks organic matter and, hence, is not suitable for plants to grow. Fourthly, because of the slow spin of the Moon about its own axis (27.3 days), there is a drastic difference of temperatures between its day and night sides. While the dayside temperature reaches as high as 121 deg C, the night side temperature drops to - 133 deg C. Finally, the Moon has a weak gravity compared to our Earth (nearly one-sixth of the Earth's gravity) and humans must be acclimatised to live on this weak gravity. Further, electrical power is required for our day to day purposes. Hence, these crucial problems have to be first resolved if we ever plan to build a human colony on the Moon.

Life Inside the Dome

To build a permanent habitat on the Moon, we need to erect a huge dome on its surface (nearly 1 km in diameter) which will provide biospheric shelter to the inhabitants and serve as the Moon city. While the Dome will be transparent to visible light, this will be opaque to harmful radiations of space like ultraviolet and cosmic rays and would prevent them from reaching the inhabitants. The Dome will also protect the Moon dwellers from the bombardment of frequent meteorite showers. The Dome will also contain and confine a recreated atmosphere and prevent these gases from escaping out. This is because the Moon's gravity is not strong enough to hold the molecules of atmospheric gases glued to its surface. Initially, all the life sustaining gases like Oxygen, Nitrogen, Carbon dioxide etc will be transported from the Earth through several rocket flights. While Oxygen will be required for respiration of living beings, Nitrogen is required to provide an inert atmosphere for reducing the chemical activity of Oxygen. It is also required to synthesize Proteins through the Nitrogen fixation process by plants through nitrogen fixing bacteria. Similarly, Carbon dioxide is required for the process of photosynthesis by plants to prepare Carbohydrates that will be used as food by humans.

Solution for Water

Initially, all the water has to be transported from the Earth through several rocket flights as the Moon has no water. However, it is believed that some deep craters , especially those located in the permanently shadowed region of the Moon's South Pole, have bottoms so cold that water might exist there in frozen form. Hence, when a rudimentary Moon colonization will be established, these waters from the Moon's distant craters should be harvested and brought back to the Moon colony for human use. Because water is precious on the Moon, not a single drop of water will be allowed to go wasted. The stored water in special storage tanks will be supplied to the homes and the used water, instead of being wasted (passing to air as water vapours due to evaporation or passing to underground by percolation through soil) will be recycled by efficient recycling plants and will be made fit

The Author demonstrating students plan of an ambitious human colony project of the Moon

for human consumption. This recycled water will be sent by pumps to the Storage tanks where it will again be supplied to the homes.

Solution for Power

Harnessing power will be a major challenge for the lunar colony. One easy way to harness power will be to erect large photo-voltaic panels outside the dome and to convert the light energy of the Sun to electrical energy. This energy will be required to run different electrical gadgets in our homes and for daily-use purposes like heating water during winter , lighting lamps during night etc.

Growing Plants

Growing plants on the Moon will be a major challenge to solve. This is because the Moon has a soil which is poor in organic matter (humus). Hence, growing plants in the Moon soil will not bear any fruit. Hence, plants could be grown by hydroponics method without soil in a special nutrient medium. Some decomposer micro-organisms like bacteria will be released in the soil to decompose organic matter and release the useful matter to the environment. As decayed plant and vegetable matter get mixed with the soil, these will increase the humus content of the soil and ,after a long time, the soil will be fit for cultivating plants.

There will be of course, rocket launch facility and large antenna for efficient transportation and communication links with the Earth respectively. First to visit the Moon will be rocket scientists and engineers who would transform the hostile conditions of the Moon favourable for further human settlers. Thereafter, miners will arrive who will harvest the minerals of the Moon and extract useful metals for building various infrastructural facilities there. They will be followed by farmers who will be growing crops and vegetables on the Moon to serve as food for the inhabitants. When a full-fledged human colony will be established, groups of men and women would fly to the Moon in regular shuttle flights to build their homes on this distant celestial body.

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8

BE PART OF THE PLAN: CONSERVING ODISHA'S RICH BIODIVERSITY

Sangram Sahoo

Overview of Odisha's Biodiversity

Odisha, located on the eastern coast of India, has a rich variety of biodiversity integrated within its various landscapes. With a total size of 155,707 square kilometres, this state has diverse ecosystems, including the challenging landscape of the Eastern Ghats, the lush forests of the Northern Plateau, and the extensive Coastal Plains. Odisha benefits from a suitable environment, with an annual rainfall ranging from 1,200 mm to 1,600 mm and temperatures that vary from 12°C to 42°C. This climate supports a diverse range of plants and animals in the region.Approximately 37% of Odisha's landscape is covered by forests, which contain a diverse range of botanical riches, including fragrant species such as Kiya, Sal, Vetiver, and Wild Lemongrass. The state is widely recognized as the second-largest producer of non-timber forest products in India, with a substantial number of its population depending on forest resources for their survival and livelihoods. In order to protect this valuable natural inheritance, the government has officially assigned 19 areas as wildlife sanctuaries, one area as a national park, and two areas as Tiger Reserves. These designated areas cover 10.37% of the forested land and 4.1% of the overall geographical area.Odisha has an impressive range of floral variety, consisting of more than 5,000 kinds of plants and fungi. This includes 24 endangered species that are unique to the area. The state's wildlife is diverse, hosting a wide variety of animals, birds, reptiles, amphibians, and aquatic species. Odisha is home to 65 faunal species that are internationally vulnerable, highlighting its importance in global conservation initiatives.

Local communities are crucial in the preservation of biodiversity, actively participating in efforts to save endangered species and their ecosystems. The mass breeding beaches of Olive Ridley Sea Turtles and the habitats of ancient organisms like Horseshoe crabs provide as evidence of these conservation efforts. In addition, the agricultural scenery in Odisha is enhanced by its agricultural biodiversity, which includes a wide range of crops and native animal breeds that are essential for ensuring food security and maintaining agricultural sustainability.

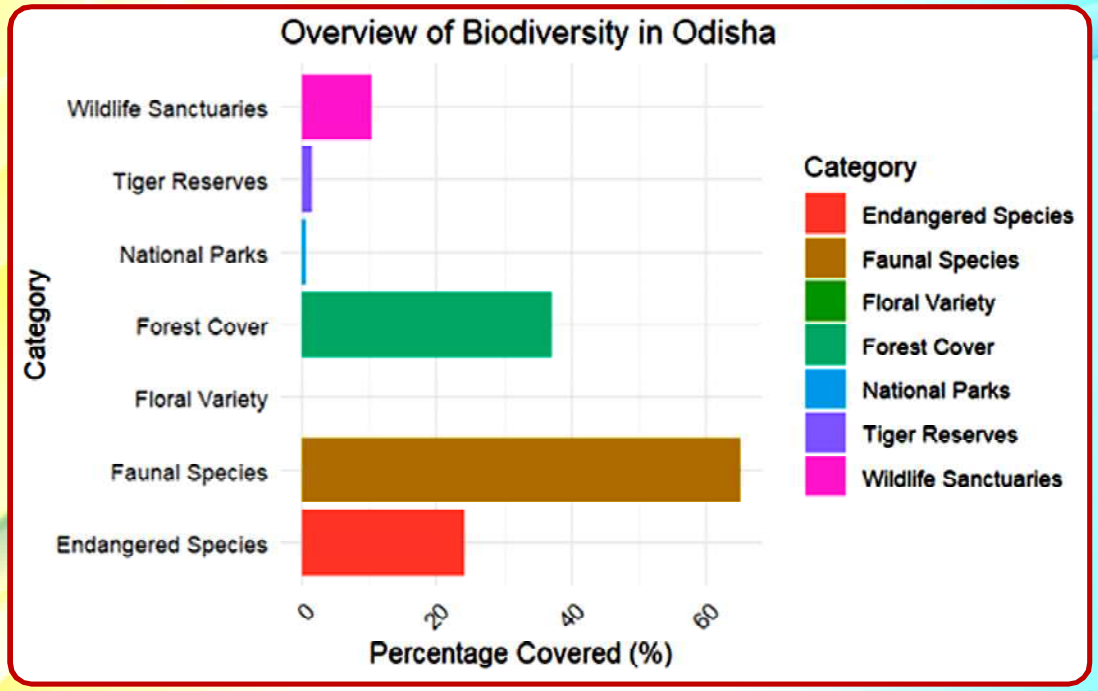


Fig.1: A static bar plot may be created using the ggplot2 package, while an interactive bar plot can be created using the plotly package. The two plots will depict the proportion of several biodiversity categories in Odisha, including forest cover, wildlife sanctuaries, national parks, tiger reserves, endangered species, and faunal species

Importance of Conservation

The conservation of biodiversity in Odisha is of utmost significance for several reasons. First and foremost, the abundant natural resources of the state sustain the lives of a vast number of people, especially those who rely on forest products and agriculture. Conservation initiatives guarantee the responsible and long-term use of natural resources, therefore protecting the local economy and people's means of living.Furthermore, the preservation of biodiversity is essential for maintaining ecological equilibrium and adaptability. The varied ecosystems of Odisha play a crucial role in providing critical services such as water purification, soil fertility, and climate management. Conserving biodiversity aids in reducing the effects of climate change, natural calamities, and other ecological difficulties, hence strengthening the state's ability to withstand these risks. The preservation of cultural assets and traditional knowledge is dependent on the protection of biodiversity. Indigenous tribes of Odisha have strong linkages with their natural environment and depend on traditional methods for their livelihood. Preserving biodiversity guarantees the perpetuation of these cultural customs and the safeguarding of indigenous knowledge systems.

Moreover, the conservation initiatives in Odisha make a significant contribution towards achieving global biodiversity conservation objectives. The state harbors a plethora of plant and animal species, including

many that are internationally endangered or exclusive to the region. Odisha's conservation efforts for these species and their habitats are vital in the global endeavor to preserve biodiversity and reduce the current global decline in species.

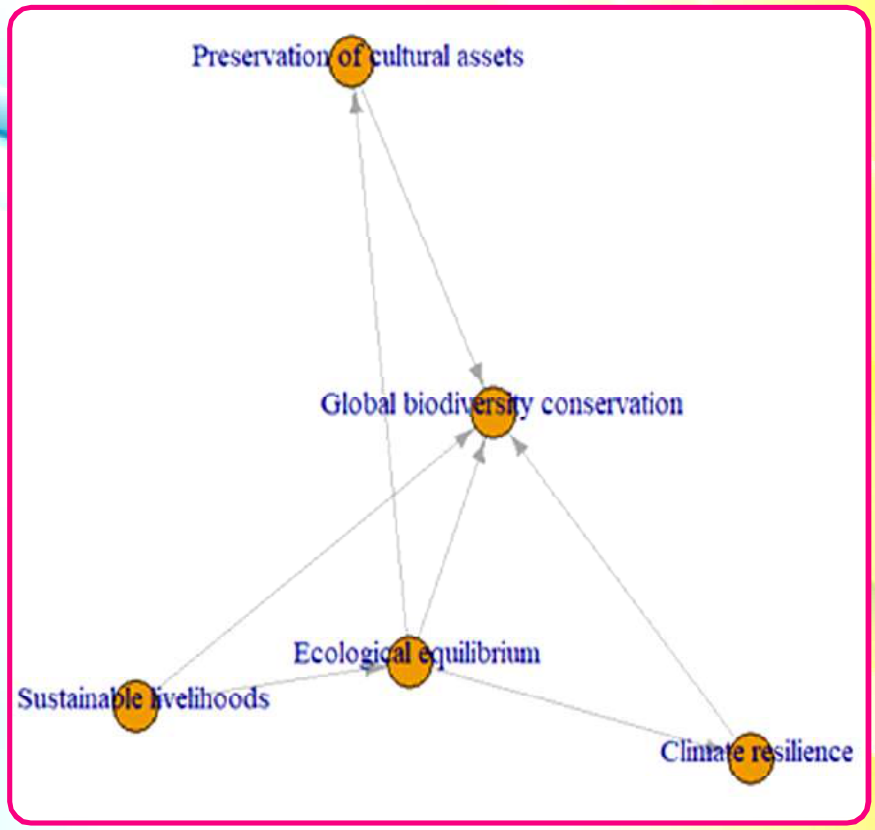


Fig. 2: This network visualization highlights the interconnectedness of key factors driving the importance of conservation in Odisha

Understanding Odisha's Biodiversity

To comprehend the biodiversity of Odisha, one must explore its many habitats, abundance of species, and the deep interdependencies between people and environment. The state's geographical position, which extends from the Eastern Ghats to the Bay of Bengal, encompasses a diverse terrain that sustains a multitude of living types.Odisha's habitats consist of forests, wetlands, grasslands, and coastal regions, each supporting a distinct collection of plant and animal species. The state's woods, which occupy a substantial area, harbor a multitude of plant species, including several ones having medicinal and fragrant qualities. These woods provide home to renowned animal species such as tigers, elephants, and a variety of birds, reptiles, and amphibians.The coastal parts of Odisha possess a significant amount of biodiversity, characterized by the presence of mangrove forests, estuaries, and sandy beaches that provide a habitat for a wide range of marine and terrestrial organisms. Mangrove ecosystems are essential for coastal defense and provide as habitats for a wide range of fish, crabs, and birds.The human groups of Odisha have enduring connections with the natural environment, depending on forest resources for their survival and livelihoods. Indigenous knowledge systems and traditional practices have a significant role in preserving biodiversity, as shown by efforts to save holy groves, indigenous rice varieties, and endemic species.The conservation initiatives in Odisha, such as the creation of protected areas and community-led conservation programs, have the objective of preserving the state's diverse and abundant biodiversity. Nevertheless, the preservation of biodiversity faces ongoing

problems, including the loss of natural habitats, the impact of climate change, and conflicts between humans and species.

In order to fully comprehend Odisha's biodiversity, it is necessary to acknowledge the intricate ecological systems, the abundance of different species, and the interconnectedness between the natural environment and human civilization. Through the promotion of sustainable practices and conservation activities, Odisha can protect its natural legacy for future generations while simultaneously safeguarding the welfare of both people and the environment.

Conservation Challenges

Odisha's abundant biodiversity and conservation efforts notwithstanding, the state has several substantial obstacles in safeguarding its natural heritage. A primary obstacle is the reduction and division of habitats caused by activities such as deforestation, urbanization, and infrastructure development. The situation is worsened by the growth of agricultural land, mining operations, and industrialization, which result in the deterioration and loss of crucial ecosystems.Climate change presents a significant obstacle, affecting biodiversity by causing changes in temperature, patterns of precipitation, and occurrences of severe weather events. Coastal habitats are under risk due to the increasing sea levels, while forest ecosystems and water availability are being impacted by changes in rainfall patterns. The climate-related consequences have the potential to disturb ecological processes and jeopardize the existence of susceptible species.Human-animal conflicts are a significant issue in Odisha, especially in regions where human settlements and wildlife habitats intersect. The encroachment into wooded regions, illegal hunting, and acts of revenge increase these conflicts, creating hazards for both human groups and animal populations.The illegal trade of wildlife and the act of poaching continue to pose substantial risks to the preservation of biodiversity in Odisha. Species such as elephants, tigers, and pangolins are specifically targeted for their body parts and derivatives. In spite of diligent enforcement measures, the presence of weak governance, corruption, and insufficient resources impede the efficacy of law enforcement and the safeguarding of wildlife.Moreover, insufficient knowledge and involvement from local populations provide obstacles to conservation efforts. Ensuring the long-term effectiveness of sustainable resource management and conservation techniques necessitates the active involvement of communities. However, doing this entails providing education, enhancing capacity, and addressing socio-economic variables.

To tackle these conservation difficulties in Odisha, a comprehensive strategy is needed that involves cooperation among government agencies, non-governmental organizations (NGOs), local populations, and other relevant parties. To address these difficulties and protect Odisha's natural heritage for future generations, it is crucial to implement efficient land-use planning, enhance law enforcement, support sustainable livelihoods, and raise awareness about the significance of

biodiversity conservation.

Conservation Efforts in Odisha

Odisha has implemented several conservation measures to preserve its biodiversity and natural habitats. Wildlife sanctuaries, national parks, biosphere reserves, and tiger reserves are vital safeguards. These protected sites are wildlife sanctuaries and ecological balance preservers. Odisha's environmental efforts depend on community-based conservation projects. By incorporating locals in sustainable resource management, boosting eco-tourism, and providing alternative livelihoods, we may reduce human-wildlife conflicts and develop conservation stewardship. The state government prioritizes endangered and vulnerable species conservation and has created programs to protect and restore their populations. Anti-poaching patrols, habitat restoration, and captive breeding programs help endangered animals survive and develop. Awareness campaigns, educational programmes, and capacity building initiatives can raise awareness of biodiversity protection and encourage environmental stewardship. Government organizations, non-profits, research institutes, and local communities work together to conserve and utilize resources. Odisha protects terrestrial, coastal, and marine habitats. The state protected mangroves, coral reefs, and marine wildlife. Coastal habitats protect ecosystems and protect against natural disasters like cyclones and storm surges.The conservation plan in Odisha includes habitat preservation, species protection, community engagement, and sustainable development. Odisha adopted these projects to preserve its natural heritage and improve people's and the ecosystem's well-being.

The Need for Action

Odisha biodiversity conservation must be addressed immediately. The state must coordinate efforts to safeguard its natural heritage, which includes different ecosystems, animals, and cultural past inextricably tied to nature, for future generations. Rapid urbanization, industrialization, habitat loss, climate change, and unsustainable resource exploitation threaten Odisha's biodiversity. These issues must be addressed immediately to ensure state ecological balance. Protected area management, wildlife trafficking and poaching prevention, and sustainable land-use practices must be improved. By encouraging community involvement via education, improving skills and resources, and supporting sustainable lifestyles, local communities may be empowered to preserve biodiversity.To successfully address climate change, mitigation and adaptation are needed. Reforestation, ecosystem restoration, and climate-smart agriculture are examples. To accomplish sustainable development while protecting biodiversity, development planning must integrate biodiversity conservation, promote ecologically friendly tourism, and support research and innovation.Public awareness, environmental education, and cooperation between government, civil society, academia, and the private sector are essential for motivating cooperative efforts and a

preservation attitude. Odisha can ensure the sustainability of its ecosystems, people, and natural heritage for future generations by prioritizing biodiversity conservation in sustainable development. Now is the time to act.

A Conservation Plan for Odisha

A comprehensive conservation plan must include Odisha's ecosystems, biological variety, and socio-economic dynamics to preserve its natural legacy. The strategy should prioritize habitat protection, species conservation, resource sustainability, and community engagement and environmental responsibility.The conservation policy should focus on expanding and managing wildlife sanctuaries, national parks, and biosphere reserves. To safeguard key ecosystems and species, law enforcement, anti-poaching, and habitat restoration must be strengthened. Community-based conservation activities must be promoted to include local people in biodiversity preservation and sustainable development. Educating, training, and giving alternative income may enable communities to own and manage natural resources.To balance conservation and development, human-wildlife conflicts must be resolved first. Habitat corridors, wildlife corridors, and conflict resolution may lessen disputes and promote peaceful coexistence between humans and animals.To prevent habitat fragmentation, deforestation, and degradation, land-use planning and development must integrate biodiversity issues. This includes promoting sustainable agriculture, forestry, and green infrastructure.To successfully address biodiversity impacts from climate change, the conservation plan must integrate climate change adaptation and mitigation measures. This includes promoting climate-resilient ecosystems, improving carbon capture and storage, and reducing greenhouse gas emissions.Finally, to implement the conservation plan, awareness, collaborations, and resources are needed. Since they can share information and resources, government organizations, non-profits, academics, and corporations may help accomplish conservation goals.A comprehensive conservation plan for Odisha that incorporates ecological, social, and economic elements may support sustainable development and protect its biodiversity and natural heritage for future generations.

Implementing the Plan

A coordinated, multi-stakeholder approach including government agencies, non-governmental organizations, local communities, and other stakeholders is needed to execute Odisha's comprehensive conservation plan. The first step is to create a dedicated task force or coordinating agency to oversee execution and promote collaboration.The approach begins with rigorous biodiversity, habitat quality, and conservation priority assessments in multiple Odisha regions. These assessments identify essential conservation measures, set goals, and effectively allocate resources.Enhancing and effectively managing protected areas requires strengthening enforcement, restoring

ecosystems, and integrating local populations. Creating more protected areas or buffer zones in important ecosystems may also help conservation efforts.Community engagement is crucial for conservation plan success. Local people may take ownership of biodiversity conservation and feel responsible by participating in awareness-raising campaigns, capacity-building, and participatory decision-making. Eco-tourism, sustainable agriculture, and non-timber forest products may encourage conservation.Creating wildlife corridors, rehabilitating ecosystems, and utilizing conflict mitigation strategies may help settle human-animal conflicts. Wildlife authorities, local residents, and stakeholders may reduce conflicts and promote harmony by working together.Land-use planning and development must include biodiversity to avoid habitat fragmentation, deforestation, and degradation. This includes enforcing zoning rules, promoting sustainable land management, and completing environmental impact assessments for development projects.Climate change adaptation and mitigation must be included in the conservation plan to strengthen ecosystems and reduce their vulnerability. This includes climate-smart agriculture, forest restoration, and carbon emission reduction.Conservation operations must be monitored and assessed regularly to evaluate progress, identify barriers, and change plans. Scientific research, stakeholder interactions, and data collection improve conservation decisions and effectiveness.The Odisha conservation plan requires persistent effort, political resolve, and effective collaboration from all stakeholders. A comprehensive and inclusive policy will help Odisha preserve its biodiversity and natural resources for future generations.

Conclusion

Maintaining Odisha's great natural heritage, ecological balance, and people wellbeing requires protecting its biodiversity. Due to its diverse ecosystems, species richness, and cultural worth, Odisha needs urgent protection. Therefore, fast and concerted action is needed to address these issues. To preserve Odisha's biodiversity, a comprehensive conservation plan must protect ecosystems, species, the community, and sustainable development. Expanding and efficiently managing protected areas, involving local communities, resolving human-wildlife conflicts, incorporating biodiversity into development policies, and implementing climate change adaptation and mitigation measures can help Odisha promote conservation and sustainable livelihoods and economic growth. Governments, non-profits, local communities, and businesses must work together to implement such a plan. Odisha can preserve its natural heritage, promote environmental sustainability, and contribute to global biodiversity conservation via joint conservation efforts. Indeed, protecting Odisha's biodiversity is a moral obligation to

.....To be Continued at Page No.-465

9 ARCHITECTURES OF PLANT IMMUNE SYSTEM

[1]Dr. Taranisen Panda
[2]Dr. Raj Ballav Mohanty

The plant immune system has evolved complex and diverse architectures to defend against a wide range of biotic and abiotic stress factors in the natural environment. These stressors include pollution, global warming, and climate change, as well as various biotic factors such as fungi, bacteria, nematodes, and non-cellular entities like viruses and viroids. Additionally, abiotic stresses such as heat, cold, drought, salinity, mechanical wounds, high light intensity, freezing, and heavy metals can also challenge plants. Plant pathogens have developed various strategies to attack plants and disrupt their growth and reproduction. The development of visible disease symptoms in plants represents an extreme outcome within the spectrum of plant-microbe interactions. Pathogenic bacteria, for example, proliferate in intercellular spaces known as the apoplast, which they access through gas or water pores like stomata and hydathodes, or through wounds. Nematodes and aphids, on the other hand, feed by inserting a stylet directly into plant cells. Fungi can enter plant epidermal cells directly or extend hyphae on, between, or through plant cells. Both pathogenic and symbiotic fungi and oomycetes can form feeding structures called haustoria, which penetrate the host cell plasma membrane. These diverse pathogens employ effector molecules, often referred to as virulence factors, to manipulate and enhance their fitness within the plant cell.

Through an evolutionary process, plants have developed specific mechanisms that enable them to detect precise environmental changes and respond to stress conditions, minimizing damage while conserving valuable resources for growth and reproduction. Plant immunity refers to a plant's capacity to prevent or withstand biological attacks by pathogens. Unlike mammals, plants lack mobile immune cells and an adaptive immune system. Instead, plants rely on a two-tier interconnected innate immune system that monitors pathogen-associated molecules, both outside and inside plant cells, with the ability to signal systemically to perceive and respond to pathogen infection sites (Jones and Dangl, 2006). The first tier of this system involves the activation of inducible defense reactions. It is based on the plant's ability to detect the presence of microorganisms through cell

surface pattern-recognition receptors (PRRs). These receptors recognize slowly evolving microbe-associated molecular patterns (MAMPs) found in a wide range of microbes. These pathogen-derived patterns are commonly referred to as PAMPs (Pathogen-Associated Molecular Patterns), such as bacterial flagellin or fungal chitin, which are typically found in the apoplastic space. Additionally, plants can recognize endogenous signals released by the plant itself in response to pathogen pressure or during abiotic stress (Choi and Klessig, 2016). When a pathogen attacks, the damaged host plant produces damage-associated molecular patterns (DAMPs), including plant signal molecules (Boller and Felix, 2009). These molecular patterns, also known as general elicitors, are recognized by pattern recognition receptors (PRRs) that are synthesized in the endoplasmic reticulum and transported to the plasma membrane (Frescatada-Rosa et al., 2015).

The second tier of the plant immune system primarily operates inside the cell and relies on polymorphic NB-LRR protein products encoded by most resistant (R) genes. These proteins are named after their characteristic nucleotide-binding (NB) and leucine-rich repeat (LRR) domains. NB-LRR proteins have the ability to recognize pathogen effectors from various kingdoms and can activate similar defense responses. NB-LRR-mediated disease resistance is effective against pathogens that can only grow on living host tissue (obligate biotrophs) or hemi-biotrophic pathogens. However, it is not as effective against pathogens that kill host tissue during colonization (necrotrophs).

Mechanism

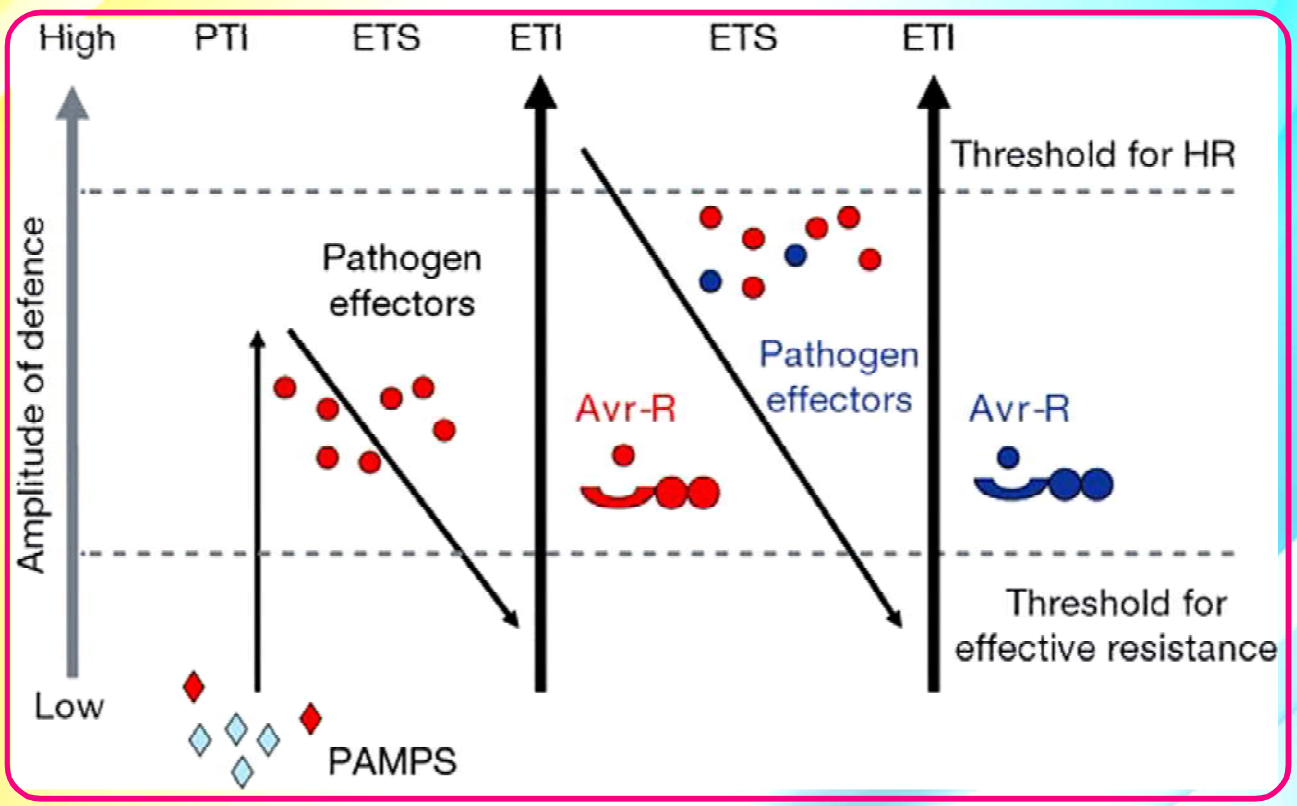
Under conditions generated by pathogen attacks, host plants can coordinate adaptive responses to ensure their survival. A sophisticated defense network is activated to orchestrate transcriptional reprogramming, employing a two-tiered defense approach. The first line of defense is Pathogen/Microbe-Associated Molecular Patterns (PAMPs/MAMPs)-Triggered Immunity (PTI). PTI involves an array of early cellular responses, including ion flux across the membrane, the production of reactive oxygen species (ROS), and the activation of mitogen-activated protein kinase (MAPK) cascade. PTI also encompasses long-term responses that lead to callose deposition (Schwessinger et al., 2015). Defense-related phytohormones play a pivotal role in these responses, with salicylic acid (SA), jasmonic acid (JA), ethylene (ET), and abscisic acid (ABA) serving as core components of immune signaling. These hormones are produced in response to both biotic and abiotic stresses. Among these, ROS, MAP kinase cascades, and hormone signaling pathways are of paramount importance as they govern the plant's defense responses to biotic and abiotic stresses (Schwessinger et al., 2015). To mitigate stress damage and adapt to their environment, plants have evolved multiple gene regulatory mechanisms involving transcriptional, post-transcriptional, and post-translational regulation (Hirayama and Shinozaki, 2010). Small non-coding RNAs

(ncRNAs) comprising 20-24 nucleotides (nt) have gained increasing attention as important regulators of protein-coding gene expression. These small RNAs function by inducing either transcriptional gene silencing (TGS) or post-transcriptional gene silencing (PTGS).

Effector-triggered immunity (ETI) constitutes the second layer of the plant's immune response, which is specific to the pathogen causing infection. It is a prolonged and robust defense mechanism activated when resistance (R) genes recognize and respond to pathogen virulence factors known as effectors that are released into plant cells (Cui et al., 2015). If the initial line of inducible non-specific defense, referred to as PTI (PAMP/MAMP-Triggered Immunity), is effectively suppressed by pathogens, the second line of plant immunity, ETI, comes into play. ETI involves the production of defense proteins that ultimately induce programmed cell death, a response known as the hypersensitive response (HR).

Conclusion

In conclusion, plants have developed diverse immune strategies to effectively



The recommended zigzag model in plant immunity (Jones and Dangl, 2006). In phase 1, plantsdetect PAMPs (red diamonds) via PRRs to trigger PTI. In phase 2, successful pathogens deliver effectorsthat interfere with PTI, or otherwise enable pathogen nutrition and dispersal, resulting in effector-triggeredsusceptibility (ETS). In phase 3, one effector (indicated in red) is recognized by an NB-LRRprotein, activating ETI, an amplified version of PTI that often passes a threshold for induction of HR. Inphase 4, pathogen isolates are selected that have lost the red effector, and perhaps gained new effectorsthrough horizontal gene flow (in blue)—these can help pathogens to suppress ETI.

counter microbial pathogens. These long-standing and ongoing interactions between plants and pathogens have played a pivotal role in shaping the evolution of both plant and pathogen genomes. When plants recognize stress signals, their immune system initiates a complex defense response, orchestrating transcriptional reprogramming through various molecular components. These components include receptor proteins, signal transduction cascades, kinase cascades, the generation of reactive oxygen species, hormone signaling pathways, heat shock proteins, and transcription factors. These mechanisms work in concert to provide plants with a robust defense system against a wide range of potential attackers. Furthermore, plant receptors involved in these processes are known to evolve rapidly through mechanisms such as point mutations, gene duplications, and gene rearrangements. This rapid evolution allows plants to adapt to ever-changing pathogen challenges and underscores the dynamic nature of plant-pathogen interactions.

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maintain the state's natural riches for everyone's benefit.

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10 TURNER'S SYNDROME-2

Col. Prof. Prafulla Kumar Mohanty

What is Turner's Syndrome?

A syndrome is a disorder of our body. It is a set of symptoms which are corelated with each other and often associated with a particular disease on disorder. The simple example of a syndrome is AIDS (Acquired Immune Deficiency Syndrome). Turner's syndrome is a type of syndrome which was first reported by a doctor Dr. Henry Turner in 1938. He is a physician of Oklahoma (U.S.).

Cause of Turner's Syndrome

It is a disorder of chromosome in which a female is born with only one x chromosome. Females have two x (xx) chromosomes. That means chromosome pattern of a normal human female is 44 + xx (2n=46). 44 are somatic chromosomes and xx are sex chromosomes. Turner's syndrome results due to a missing or (Fig.1) incomplete sex chromosome or the absence of one sex chromosome. This absence of one sex chromosome may be due to deletion or non-functioning of one x chromosome. So, the chromosome pattern in Turner's syndrome is 44+xo (45x or 45 xo) or monosmy x (missing of an x chromosome in 23rd pair).

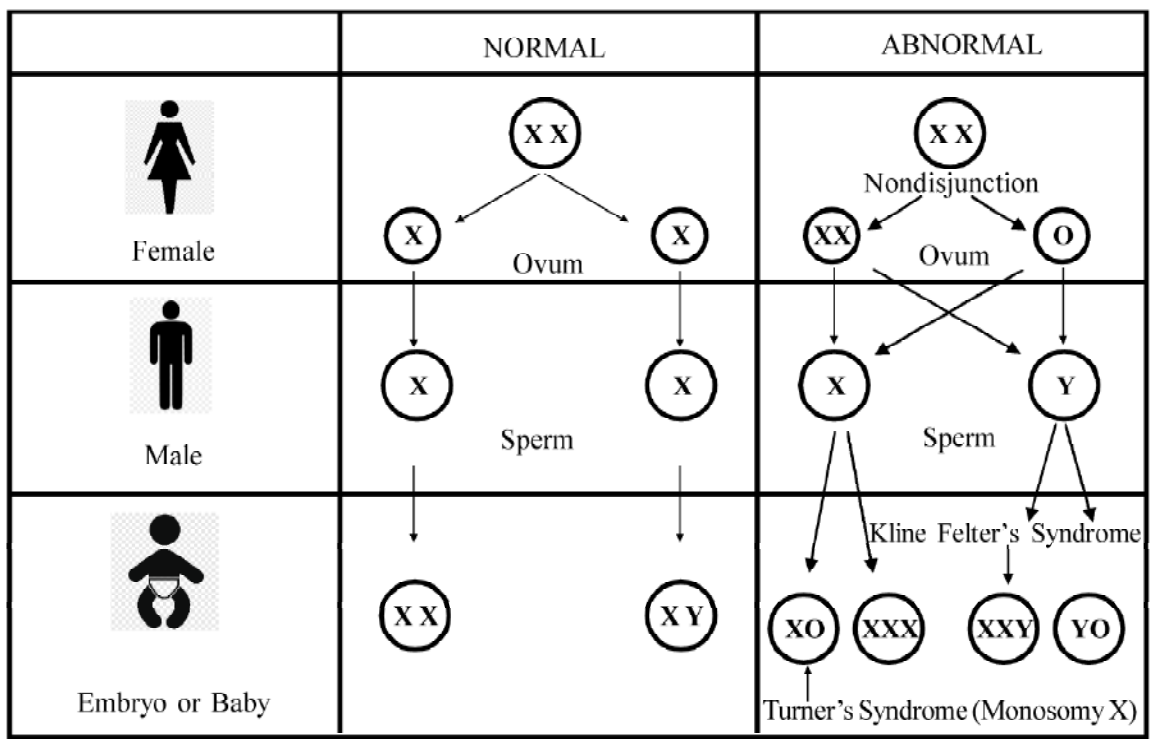
How does Turner's Syndrome Occur?

This syndrome occurs right from development in mother's body. Therefore, it is called as congenital disorder. The other terms of this problem is "gonadal dysgenesis" or "congenital ovarion hypoplasia" since it is releated to the problem of ovary. In India, the number of this type of disorder is fewer than one million cases per year. Normally, the frequency of this case is one in every 2,000 (two thousand) to 2,500 (two thousand five hundred) females (born baby girls). Since the ovaries are improperly developed or rudimentary in nature, it does not function properly and menstruation fails to occur.

Symptoms of Turner's Syndrome

Following symptoms are observed in Turner's syndrome. Several health issues are found in these victims.

1. Short stature
2. Delayed puberty
3. Infertility (sereak ovaries, amenorrhea)
4. Heart defect (congenital cardiac disease)
5. Certain learning disability (educational difficulties)
6. Abnormality of reproductive organs



7. High blood pressure
8. Osteoporosis
9. Narrowing of aorta (blood vessel) or coarction of aorta
10. Failure of teeth development
11. Abnormality in raised roof mouth and small jaw bones
12. Absence of menstrual cycle
13. Soft nails that turn upward (dysplastic nails)
14. Recurrent ear infection
15. Widely spaced nipples
16. Celiac disease
17. Deformity in elbow
18. Hearing loss (middle ear infections)
19. Increased number of moles on the body
20. Kidney malfunction
21. Obesity (fat body)
22. Puffy hands and feet at birth (swollen limbs)
23. Scoliosis (curvature of spine or vertebral column)
24. Underactive thyroid
25. Low set of ears
26. Drooping eyes
27. Diabetes type II
28. Short and wide neck

Diagnosis and Cure

Turner's syndrome can be known or diagnosed by chromosomal analysis. This method is called as "karyotype" or "karyotyping" or "karyomorphometrical analysis". This analysis answers that there is absence of one sex chromosome, that is, 44 + xo. Since it is a chromosomal disorder, there is no cure. However, growth hormone either alone or with other hormone treatment may improve growth. If at all the Turner's syndrome females get pregnant, 98% pregnancies end in miscarriage.

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11 LIQUID TREE: A NOVEL SOLUTION TO URBAN AIR POLLUTION

Dr. Debasis Swain

According to the World Health Organization, ambient air pollution causes 4.2 million deaths per year, making it the largest single environmental health risk. The vast majority of these pollution-linked deaths occur in low and middle income cities in Africa, Asia, and Latin America. India is home to 22 of the world's 30 most polluted cities, with average annual PM2.5 concentration up to 14 times higher than WHO guidelines. The air quality index (AQI) is measure of pollution in a scale from 0 to 500.The higher the value of AQI the worse is its quality. Most of the cities in Odisha like Bhubaneswar (smart city) are moderately polluted in terms of AQI category. Haryana and Punjab are under poor category and Mizoram, Odisha, Jharkhand, Jammu and Kashmir, Himanchal Pradesh, Daman and Diu, Manipur, Meghalaya and Dadra Nagar Haveli are coming under good category. All other states including New Delhi are coming under moderate category.

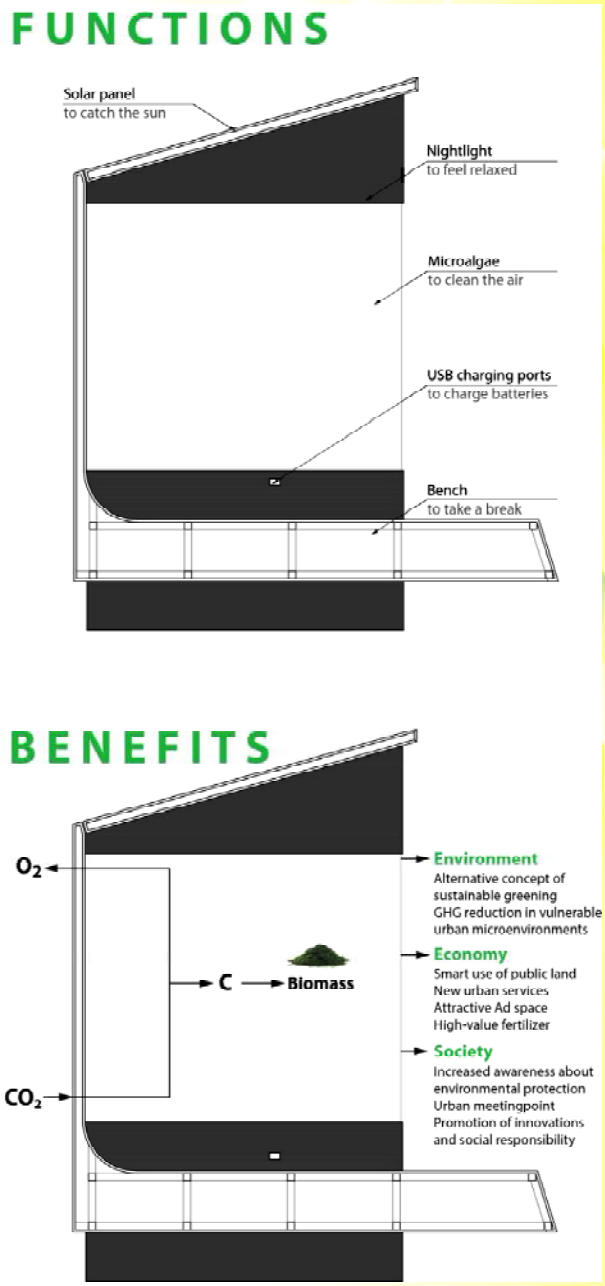
Dr. Ivan Spasojevic

Dr. Ivan Spasojevic is a biophysical scientist of institute of multidisciplinary research of University of Belgrade developed the liquid tree in September 2021. The scientists were looking for a way to combine the efficiency of microalgae to bind carbon dioxide in highly urban cities. First Liquid tree was installed in front of the Municipality of Stari Grad in Belgrade. It is an urban photo-bioreactor. It contains microscopic fibres from plant cell wall.

AQI range	0-50	51-100	101-200	201-300	301-400	401-500
AQI category	**Good**	**Satisfactory**	**Moderately Polluted**	**Poor**	**Very Poor**	**Severe**

Major air pollutant in india

PM 2.5	PM 10	CO	SO_2	O_3	NO_2



When we think of trees, we usually visualise solid structures with roots, trunks, branches, and leaves. However, a new concept has emerged that modifies this traditional idea of trees. Liquid trees are a fascinating and innovative idea that has captured the attention of scientists. The innovative way to mitigate air pollution the use of these trees particularly with respect to urban pollution popularly referred to as "Liquid 3". Its history started from Serbia (in Belgrade) as an alternative way to solve air pollution.

Working Mechanism

It uses the power of microalgae to efficiently remove CO_2 and produce O_2. Liquid tree replaces one adult tree or 200 m^2 of lawn. The Liquid tree is equipped with a 600-liter water chamber housing a multitude of single-

celled freshwater algae. These algae are native to ponds and lakes, making them resilient to both high and low temperature stress. Their primary function is the absorption of CO_2 from the atmosphere, conducting photosynthesis, and subsequently producing pure oxygen. After a month and a half, the biomass of the algae is harvested, and the water is replenished with added minerals. The harvested biomass serves a dual purpose, as it is employed as a fertilizer for crops and plants. Furthermore, the "Liquid Tree" has a solar panel on the top using dead biomass of algae, which captures solar energy, converting it into electricity, which is then used to power a pump responsible for introducing air into the tank through small perforations. This electrical supply also enables the tank to emit light, facilitating year-round, uninterrupted photosynthesis by the microalgae, even during the winter months when sunlight is less abundant. In addition, this tank acts as a bench, the solar panel includes charging capabilities for mobile phones and provides light during the night.

One of the main advantages of liquid trees is their versatility. Unlike traditional trees that require specific soil conditions and climatic factors to thrive, liquid trees can be deployed in a variety of settings, from urban areas to deserts. It cannot substitute the tree in terms of cool shade but it can certainly reduce the pollution level and the temperature to some extent. The cost and time factors are important. Liquid Tree also acts as a bench; has chargers for mobile phones, as well as a solar panel that provides the bench with lighting during the night. The efficiency of liquid trees also makes them advantageous because they have the capability to absorb more pollutants and sequester more carbon due to their larger surface area. They are more resistant to heavy metals than trees. Through analysis of biomass, it was found that they clean 300 to 3,000 cubic meters of air from heavy metals. They can also be integrated with other green infrastructure systems such as green roofs and rain gardens in order to create a more holistic approach to urban greening.

Uses of Liquid Tree

1. **Promoting Urban Greenery**

Liquid Trees contribute to enhancing the greenery in concrete urban environments, providing an aesthetically pleasing effect to urban landscapes.

2. **Reduction in CO_2 Emissions**

Liquid Trees can capture and sequester carbon dioxide from the atmosphere, playing a pivotal role in mitigating the greenhouse effect and addressing climate change.

3. **Improving Quality of Air**

Through the absorption of carbon dioxide and other pollutants from the atmosphere, along with the release of pure oxygen, Liquid Trees contribute to enhancing air quality, making it healthier for inhalation.

4. **Wastewater Treatment**

When waste water is passed through a photo-bioreactor, the contained algae act as

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12

COOLMITT- THE NOVEL TECHNOLOGY IN 2024 OLYMPIC

Dr. Bibhuti Narayan Biswal

Introduction

Over the years technology is becoming an integral part of international sports events like the Olympic, Commonwealth Games, Asian Games, etc. France hosted the Summer Olympics 2024 in a row for the third time from July 26 to August 11, 2024. The country will mark its Centennial Celebration (100th anniversary) of the Olympic Games last time hosted i.e. the first time being 1900, and the second one in 1924.Approximately 10,000 athletes (with an equal number of male and female athletes) from more than 200 countries competed in Paris Olympic 2024.The entire world witnessed the synergy of technology and sports in the 2024 Olympics. One such unique cooling technology called CoolMittis was used to beat the heat in the Paris Olympics.

Unique Features of the Paris Olympic

1) Sustainability

It was aimed to be the most sustainable Olympics with 95% of venues being existing or temporary structures and no provision of air conditioning at the Olympic Village site.The 2024 Olympics was planned in such a way as to ensure a reduced carbon footprint by promoting public transportation, using renewable energy, and minimizing waste during the games.

2) Technology Deployment in the 2024 Olympic

Paris Olympic 2024 demonstrated the integration of the most advanced technology for various purposes like ticketing, broadcasting, and athlete tracking, to enhance the experience of participants.

- Artificial Intelligence (AI) algorithms was used to analyze vast amounts of data to provide insights, predictions, and real-time decision-making support to organizers and also to improve athlete performance, optimize event management, and enhance security.
- Biometric sensors were used to measure unique physical characteristics such as fingerprints, facial recognition, and retinal scans to ensure security and improve the health monitoring systems of all athletes.
- Hydration monitoring devices were used to measure hydration levels in real-time

and alert athletes when they need to drink fluids and it helped athletes optimize athlete hydration and performance.

- Wearable devices like smartwatches, fitness trackers, and smart clothing track metrics (such as heart rate, movement, and body temperature) were used by athletes. It helped in monitoring and enhancing athletes' performance and health. One of the unique wearable devices is CoolMitt.

CoolMitt&Thermoregulation Technique

The science of heating and cooling the body constitutes a process called thermoregulation, and how to apply that knowledge to significantly improve physical performance is a matter of great curiosity for research scientists. This made Craig Heller a professor of biology and his colleague Dennis Grahn, at Stanford University curious to investigate human temperature regulation and its role in athlete's performance. Accordingly, they ended up devising a wearable device to help athletes rapidly cool their body temperature. It uses a combination of vacuum and cooling technology to lower body temperature, enhancing performance and recovery. This gave birth to the cooling technology called 'CoolMitt technology' that helps athletes stay cool, recover faster, and perform better.

Science of CoolMitt

Humans are warm-blooded animals. We function normally around 37 degrees Celsius body temperature. But when it rises to 40 degrees Celcius, we can not function normally. In that case we live very close to the edge. Most mammals have a nice blanket of insulating hair all over their bodies. We humans do have millions of hair follicles that work as blankets to control body temperature. When it comes to losing heat by humans, we generally do it through glabrous skin (i.e. the bottoms of feet, palms, and face).

Our bodies do, however, have a kind of emergency temperature relief valve, which is a special type of blood vessel called arteriovenous anastomoses (AVA).They are direct junctions of arteries and veins, so blood flows through them pretty quickly. In the palm of the hand, the soles of the feet, and the upper part of the face, which are called non-hairy skin, there are special blood vessels (AVAs), and those blood vessels can shunt the blood from the arteries to the veins directly, help in heat exchange from the body with the surrounding.

CoolMitt works as a thermal exchange device, (as given in **Fig. 1**) serves as a quasi-vacuum and expands the veins in the palm. In the device, there are Plexiglass cylinders around which are sealedon one end. Inside the cylinder, cool water run over continuously. By simply inserting the palm into a temperature-regulated perfusion bag/gloves for between 3 to 5 minutes, overheated blood would be induced into the AVA's of a person's palm. From there, cold flowing water from the tubes of CoolMitt would transfer that heat away from the AVAs, cooling the person's blood and

ultimately lowering their body temperature. Then, cooled down, blood would circulate back to the body's core and lower the heat there. All these changes happen in just a few minutes and athletes return to regular body temperature quickly.

Impact of CoolMitton Athelets Performance

In non-air conditioning venues, there is a fear of managing body temperature. This time Paris faced a hot summer and all the athletes faced the problem of summer which would have affected their performance. When our body gets really hot, it is manifested in the signs of heat stress - heavy sweating, clammy skin, muscle cramps, dizziness, etc. Then the question is - What is the way to cool down the body temperature? It is frequent baths or drinking cold water or ice bath or the cold floor, anything else?

CoolMitt is designed to be used during timeouts in games, in between sets and reps in the gym, or any short break in training or competition. If athletes take the heat out of the core of the body, that prevents heat from building up in the active muscles, and they keep on working. So what CoolMitt does is prevent hyperthermia, (a rise in body temperature to a dangerous level). And therefore it enables them to have a higher work volume. If they have a higher work volume, athletes get a bigger conditioning effect and have high performance in their games.

Competitive Edge of CoolMitt

CoolMitt is a special wearable device that athletes wear to cool their bodies quickly

Figure 1: Typical CoolMitt

using a combination of vacuum and cooling technology. It, helps them recover faster and get ready for their next event. The cooling of palm, sloes, and face areas with specific protocols can allow athletes to perform 200-600% more volume and repetitions of resistance exercises at the same weight loads, or to run, cycle, or swim significantly further.

Friedrich Tyler, associate athletics director for applied performance at Stanford University, said the CoolMitt makes a difference. From many instances, we have noticed that the athletes notice themselves feeling like at the end of the game although they have as much energy left in their legs as they did at the beginning.This helps athletes to go a really long way in terms of both for psychological performance but also actual outputs and performance during any competitions."The CoolMitt has been used successfully by USA Wrestling, the National

Basketball Association (NBA), the National Football League (NFL), and Major League Soccer (MLS),etc.

Conclusion

In Summer , an athlete might get very hot during a long-distance race, 4X4 relay, Marathon, cycling, or even team sport slow down their performances, and not finish as strongly as they planned for. With their body temperature controlled, athletes can maintain their peak performance for longer, leading to better results in their events. By the use of cooling technology likeCoolMitt,athletes can surely cool down their body temperature quickly, maintain their speed, and finish the race strong, possibly winning medals because they are better prepared and less likely to suffer from heat exhaustion.

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filters to remove pollutants such as nitrogen, phosphorus, contaminants, and organic matter.

5. **Medicinal Applications**

Various microorganisms, including algae, can produce bioactive compounds with significant applications in the field of medicine. Cultivating such algae in a controlled bioreactor environment facilitates the extraction of these bioactive compounds, as compared to their growth in natural habitats.

6. **In Space applications**

Photo-bioreactors hold the potential to be employed for carbon dioxide removal and oxygen generation within spacecraft. Additionally, they offer the possibility of cultivating green salads to support astronauts' dietary needs.

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13 SUPERFECUNDATION

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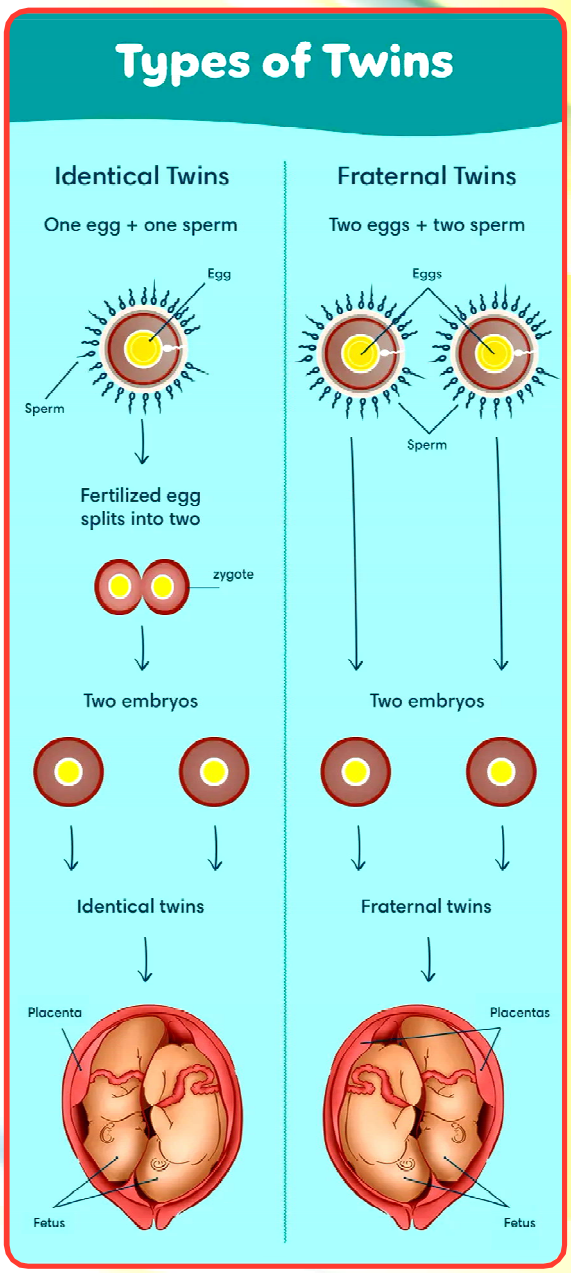
Pregnancy with twins or triplets can happen by accident. In other instances, certain considerations come into play. For instance, hormonal changes leading to the release of many eggs at once increase the likelihood of a twin pregnancy as one age. In-vitro fertilization and other assisted reproductive technologies raise the likelihood of twins or other multiple births.

The most prevalent type of twins are fraternal twins, which are produced when two distinct eggs are fertilized by two distinct sperms. Every twin has a unique amniotic sac and placenta. The twins might be a boy and a girl, or a girl and a boy.

When one fertilized egg divides and produces two babies, the result is identical twins. A placenta and an amniotic sac may be shared by identical twins, or the twins may have distinct amniotic sacs yet share a placenta. The two babies are the same genetically. They will be of the same sex and have similar physical attributes. Identical twins seldom fail to fully manifest as two distinct persons. We refer to these infants as conjoined twins.

Higher-order multiples, such as triplets, might be fraternal, identical, or a mix of the two.



Placenta and Amniotic Sacs

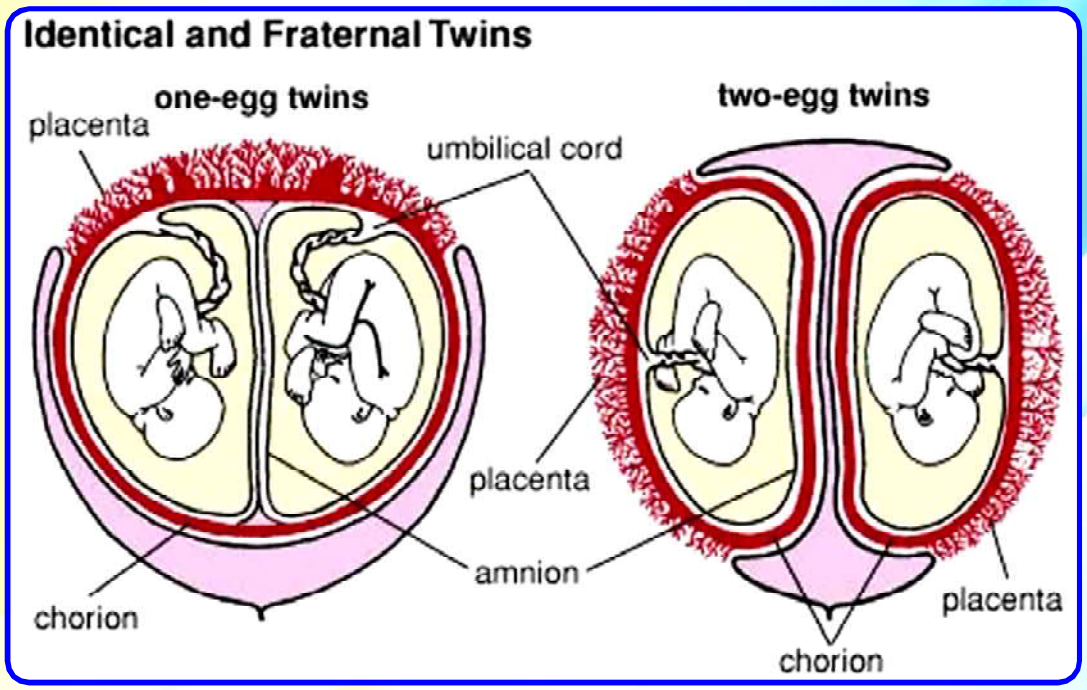
A placenta and an amniotic sac may not be shared by all twins, however, this is not the case in the great majority of pregnancies. Here are three major possibilities that exist:

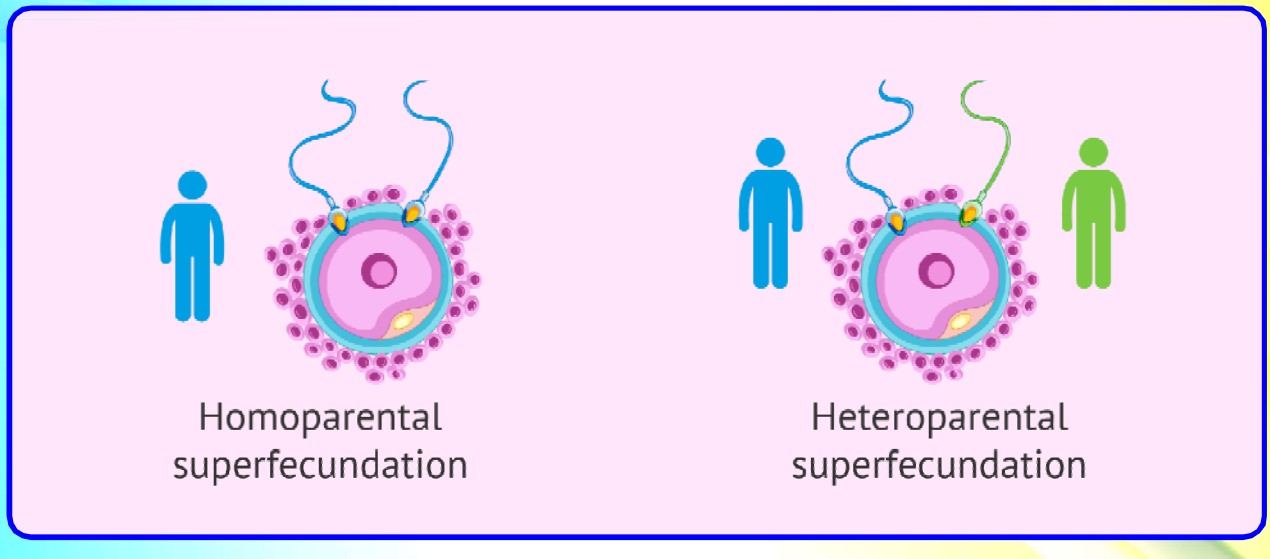
- **Two placentas and two amniotic sacs**. The ideal twin pregnancy contains two placentas and two amniotic sacs since each fetus has its own barrier and supply of nutrients.
- **One placenta and two amniotic sacs**. Identical twins are given in pregnancies with a single placenta and two amniotic sacs. In addition, there's a higher chance of issues like twin-to-twin transfusion syndrome when your kids share a placenta. Your doctor will keep a careful eye on your pregnancy to look for any potential issues.
- **One placenta and one amniotic sac**. The rarest and riskiest kind of twin pregnancy is this one. Tangling of the umbilical cords or an imbalance in the blood, nutrition, or other life-sustaining systems might result in foetal problems.

Superfecundation is the process by which sperm from distinct sexual actions fertilize two or more ova from the same cycle, potentially producing twins with different biological fathers. Fecundation is derived from the word "fecund," which means "able to produce offspring." When two separate ova from the same father fertilize, it results in homopaternal superfecundation, which produces fraternal twins. In contrast, heteropaternal superfecundation is a type of typical twinning in which the twins are genetically half-siblings, sharing the same mother but having different fathers.

Conception

Before an egg disintegrates after ovulation, it can survive inside a female's body





for a maximum of five days, during which time the sperm cells can continue to exist. Superfecundation occurs when ova are released within the same cycle, usually hours or days after the initial fertilization event.

In order to reduce the chance of further ova becoming fertilized and to improve the likelihood of a full-term pregnancy, ovulation is typically stopped during pregnancy. There is a probability of a second pregnancy, albeit at a different developmental stage, if an ovum is abnormally released after the female has already become pregnant when she previously ovulated. Superfetation is the term for this.

Heteropaternal Superfecundation

Animals like dogs and cats frequently experience heteropaternal superfecundation. It is possible for stray dogs to create litters where each puppy has a different sire. Although uncommon in humans, reports of cases exist. In a human study, dizygotic twins whose parents had participated in paternity cases had a prevalence of 2.4%.

Selected Cases involving Super-Fecundation

In 1982, it was shown that heteropaternal superfecundation was the cause of twins with two different skin tones at birth.

A case of spontaneous monopaternal superfecundation was documented in 2001, wherein an IVF patient gave birth to quintuplets after implanting only two embryos. Genetic testing confirmed that all five boys had the same father and that the twinning was not the consequence of the embryos dividing.

A heteropaternal superfecundation was established on live air in 2008 during a paternity test on The Maury Show. A New Jersey judge decided in 2015 that a man who was the biological father of only one of the twins' children should only be responsible for the other's child support.

An IVF-implanted surrogate woman gave birth to two children in 2016: a biological child derived from her own egg and her husband's sperm, and a genetically unrelated

Homoparental Twins

Heteroparental Twins

child from an implanted embryo.

A Chinese woman reportedly had two infants in 2019 - one from her husband and the other from a man who was having an extramarital affair with her at the same time.

A 19-year-old Brazilian woman from Mineiros gave birth to twins in 2022, one day after having sex with two separate fathers.

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RECENT NEWS ON SCIENCE & TECHNOLOGY

Drifting Away of Moon

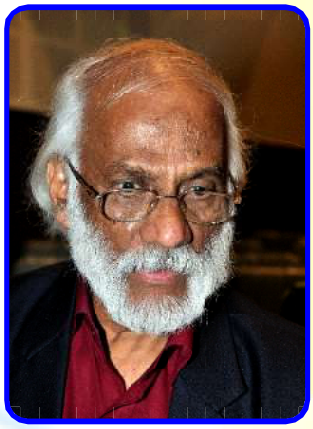
The Moon is slowly but steadily moving away from the Earth, which will have a direct impact on the length of the day on the Earth.One complete rotation of the Earth on its own axis takes 24 hours, which is also known as one day. This rotation is heavily influenced by other astronomical bodies, including the Moon, which is slowly but steadily drifting away from the Earth, directly impacting the rotational speed of the Earth, suggests a study by the University of Wisconsin-Madison.

Scientists have now speculated that 1.4 billion years ago, the Earth completed one rotation in 18 hours, and the rotation speed is continuously decreasing as the Moon drifts away from the Earth. This study was done on rock from a formation aged 90 million years, to analyse the Earth's interaction with the Moon. The Moon is currently 3,84,400 km away from Earth, and it takes exactly 27.3 days to complete one full rotation around the Earth.

As per the study, the Moon is drifting away at a pace of 3.82 centimetres a year, which could result in 25-hour long days on Earth 200 million years from now. Scientists call these variations "Milankovitch cycles", and they determine where the sunlight is distributed on the Earth along with the climate rhythms.

Rashtriya Vigyan Puraskar 2024

The President of India, Smt. Droupadi Murmu presented the Rashtriya Vigyan Puraskar-2024 at an award ceremony held at Gantantra Mandap, Rashtrapati Bhavan on August 22, 2024.In the first edition of the Rashtriya Vigyan Puraskar, 33 awards were presented to distinguished scientists in four categories - Vigyan Ratna, Vigyan Shri, Vigyan Yuva, and Vigyan Team.

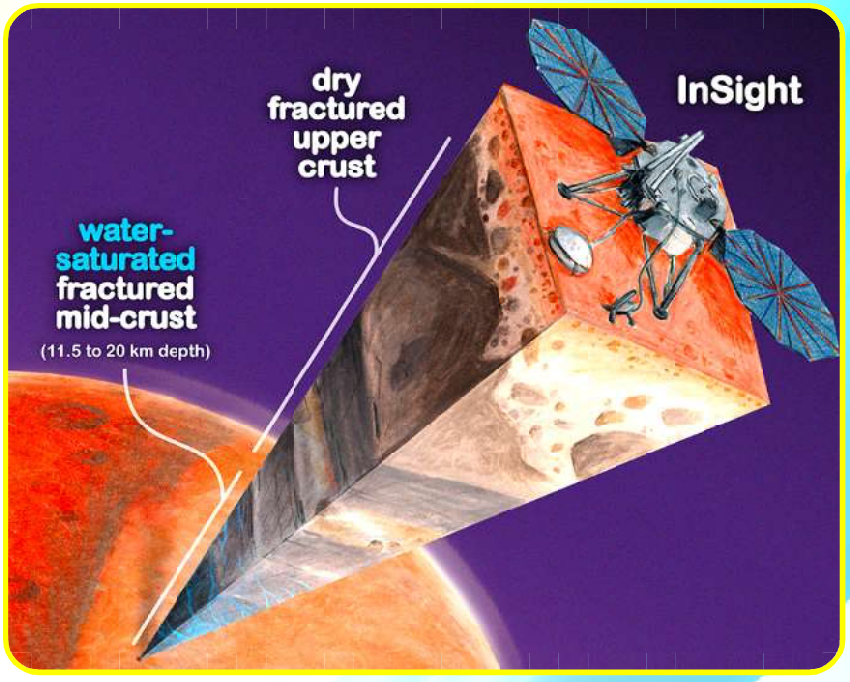


Prof. Govindarajan Padmanabhan

The Vigyan Ratna Award, given to the scientists who have made lifetime contributions in any field of Science and Technology, was presented to Prof. Govindarajan Padmanabhan, a pioneer of molecular biology and biotechnology research in India. The Vigyan Shri Awards, given to the scientists who have made distinguished contributions to Science and Technology, were presented to 13 scientists for their path-breaking research in their respective domains. The Vigyan Yuva-SSB award, given to recognize scientists who have exceptionally contributed to any field of science and technology, was given to 18 scientists for their significant contribution in the areas spanning from the study on the warming of the Indian Ocean and its consequences, to the development of indigenous 5G base station and communication and precision tests of quantum mechanics. The Vigyan Team Award, given to a team of 3 or more scientists for making ground-breaking research contributions in any field of science and technology, was given to the team of Chandrayaan-3 for the successful landing of Chandrayaan-3 lander near the south pole of the moon.

Water in Mars

One of the prerequisites for life is liquid water-and there's direct evidence of it having once existed on Mars. However, that was billions of years ago, and today the planet's temperature is well below the freezing point of water, meaning that any water near or on the surface is almost certainly frozen solid. However, a new study published August 9, 2024 in *Proceedings of the National Academy of Sciences* suggests that there may be liquid water in Mars. The study suggests that there's liquid water deep, deep in the Martian crust—at least five miles down, and potentially as far as 15 miles.



The study is based on data gathered by NASA's InSight lander, which landed on the Martian surface in November 2018 and operated until late 2022. The lander gathered extensive information about Martian geology.

Compiled by
EDITOR

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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 send their articles by typing **(in MS Word)** to avoid errors in reading handwritten article and send it through e-mail given below.
4. The authors are requested to write clearly on one side of A4 size paper. The relevant pictures in 4cm X 6 cm size are welcome. **Photo copies of manuscripts are not accepted for consideration.**
5. Each article will be ordinarily of two to three printed pages in A4 size papers.
6. The article shall be profusely illustrated with pictures.
7. At the end of the article the author should give the references and suggestions for further reading.
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