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Young Scientist India

A Science & Innovation Magazine for Curious Teachers



SUSTAINABLE DEVELOPMENT GOALS

Tessy Thomas
M. R. Srinivasan
G. Balakrish Nair
Narinder Singh Kapany

Arihant Class Submarine Technology
Drone-Based Medical Delivery Networks
Rethink, Reuse, Reimagine
Innovating for Water Conservation

Young Scientist India

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Editorial

Publisher

Murali Valiveti

Editor

Vennela Valiveti

Content Director

Krupa Kiran Nandamudi

Contributors

Bharath Valiveti
Rishita Raj Sirivolu
Joycee Fleroma Vanja
Padma Priya Sikhakollu
Naveena Savanam
Ramya Sri Vutukuri

From the Editor's Desk

Welcome, Young Scientists!

Get ready to embark on an exciting new journey of discovery! Every issue of **Young Scientist India** is packed with fresh ideas, fascinating concepts, and hands-on thinking, and this month's edition is filled with incredible topics to spark your curiosity and expand your horizons.

Our Cover Story dives into **Sustainable Development Goals**, unpacking what the SDGs are and why these global targets matter to every single one of us. It breaks down how individual actions connect to global challenges, showing that understanding these goals is the first step toward building a fairer, cleaner, and more sustainable future for everyone.

Transforming knowledge into real-world impact requires a practical mindset. In this month's Innovation Training Modules, we explore **Rethink, Reuse, Reimagine** and **Innovating for Water Conservation**. These guides offer fun, actionable ways to rethink daily habits and design resourceful solutions for conservation.

Scientific wonder often begins with the most ordinary things. Have you ever wondered about the complex physics inside a teacup? In **Tea Leaf Paradox**, we uncover the surprising fluid dynamics hidden in your daily routine! Paired with feature articles like **Digital Tools for Learning** and **Simple Science, Powerful Ideas**, you'll see how keen observation and basic scientific principles can turn everyday moments into big insights.

We also celebrate India's rich landscape of technological leaps and visionary thinkers. Read about pioneering scientists such as **Tessy Thomas, M. R. Srinivasan, G. Balakrish Nair** and **Narinder Singh Kapany**, and discover remarkable home-grown achievements, from **Drone-Based Medical Delivery Networks** to the **BrahMos Supersonic Cruise Missile**.

Our student showcase highlights inspirational student innovations where bright young minds tackle real-world problems with creative ideas like **AI Wildlife Alert Systems, Powerless Speakers**, and **Voice Assistants for the Deaf and Mute**.

Plus, don't miss our monthly **Brain Teasers and Puzzles**, updates on **S&I News and Events**, and features on leading research institutions like the **NML, NPL, URDIP** and **IACS**.

Dive in, explore with enthusiasm, and keep asking "why"!

Happy reading!



Vennela Valiveti, B. Des.
YSI Magazine Editor
Interior Designer
Ph. 9030600470

S&I Article

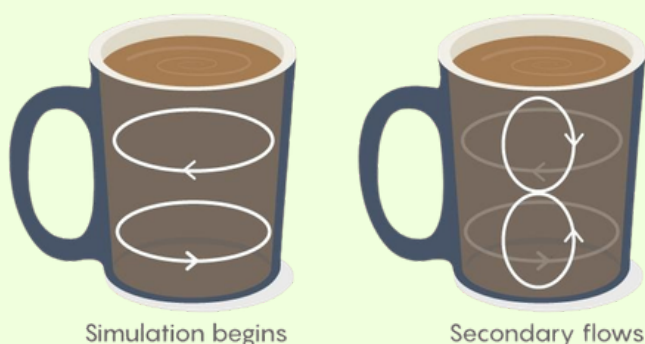
Tea Leaf Paradox

The Fluid Dynamics of Your Morning Tea



Every morning across India, millions of people enjoy a cup of chai. Whether it is at home, in a school staff room, or at a roadside tea stall, tea is more than just a drink, it is a daily ritual. But have you ever noticed something curious while stirring your tea?

When you stir a cup of tea, the tea leaves or small particles don't move outward to the edges as you might expect. Instead, they gather at the **center of the cup's bottom**. This surprising behavior is known as the **Tea Leaf Paradox**, a classic phenomenon in fluid dynamics.



At first glance, it may seem like a simple observation, but it reveals deep scientific principles about how liquids move. This paradox connects everyday life with advanced concepts in physics and engineering.

For students, it is a perfect example of how **science is hidden in simple daily experiences**.

What is the Tea leaf paradox?

The Tea Leaf Paradox describes the movement of particles in a rotating liquid. When tea is stirred, the liquid spins, creating a circular motion called a vortex. One might expect the leaves to move outward due to centrifugal force. However, they instead collect at the centre bottom.

Why does this happen?

Because of a special flow pattern called **secondary flow**, where friction between the liquid and the cup slows down the fluid near the bottom. This creates a pressure difference that pushes particles inward.

Where can this be observed?

Anywhere, from your kitchen to a tea stall, from a school lab to a science exhibition.

When was it discovered?

The phenomenon was explained by the famous scientist **Albert Einstein**, showing that even simple observations can lead to important scientific insights.

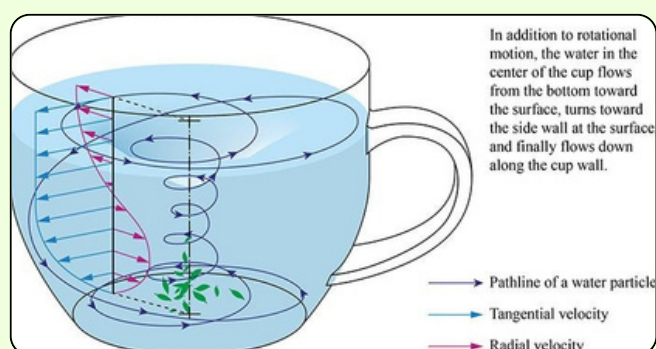
Who studies this?

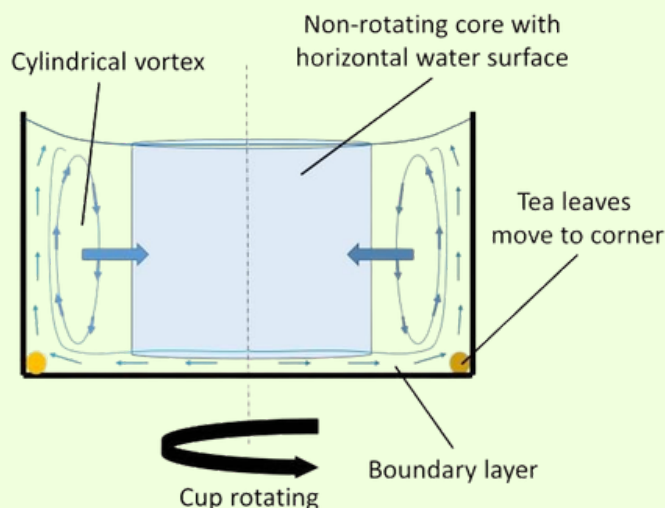
Physicists, engineers, and fluid dynamics researchers, but the beauty is that even students can observe and understand it.

Tea leaf paradox procedure

When you stir tea, the liquid rotates, forming a vortex. The top layers move faster, while the bottom layers move slower due to friction with the cup. This difference in speed creates a circular flow pattern.

As a result, particles are pushed outward at the surface but pulled inward along the bottom, eventually settling at the centre.





This process involves key scientific concepts such as:

- Circular motion
- Friction
- Pressure differences
- Fluid flow patterns

These principles are not limited to tea cups. They are used in designing pipelines, understanding river flow, and even in atmospheric science.

Success Stories

The same principle can be seen in nature and technology. In rivers like the Ganga, sediments often settle on the inner side of bends due to similar flow patterns. Water treatment plants use these principles to separate impurities.

Cyclone separators in industries use rotational motion to separate particles from fluids. Even irrigation systems depend on understanding fluid flow.

These real – world examples show that a simple cup of tea can explain large – scale natural and industrial processes.

Future Impact

Fluid dynamics is a rapidly growing field. Understanding such concepts can help in developing technologies like advanced water purification systems, efficient transportation of fluids, and even medical devices.

Students interested in physics, engineering, or environmental science can explore these areas further. With the help of simulations and experiments, future innovators can design better systems for society.

DIY Activity: Observe the Tea Leaf Paradox

Take a transparent cup of water or tea. Add small particles like tea leaves or pepper. Stir the liquid gently and observe what happens.

Watch carefully as the particles move and eventually settle at the centre bottom. Try stirring at different speeds and observe the changes.

This simple experiment helps you understand complex fluid behaviour using everyday materials.

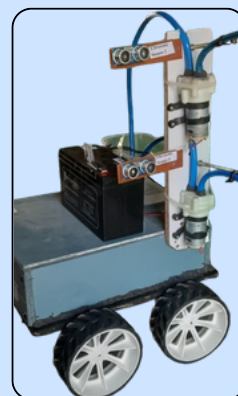
Conclusion

The Tea Leaf Paradox reminds us that science is not limited to textbooks or laboratories; it is present in our everyday lives. A simple cup of tea can reveal complex principles of fluid dynamics and inspire deeper curiosity.

For students, this is a powerful lesson: innovation begins with observation. By asking questions and exploring simple phenomena, young minds can develop a scientific mindset and contribute to future discoveries.

Automatic Pesticides Sprayer

Problem: Priyanka's idea focuses on the development of an automatic pesticide sprayer designed to prevent unnecessary spraying on the ground, ensuring that pesticides are applied only to the plants. The robot is equipped with two ultrasonic sensors at the front to detect obstacles. When a plant is detected, the sprayer activates and applies pesticide directly to the plant. The spraying intensity is adjusted based on the plant's height: for shorter plants, a lower level of spray is applied, while taller plants that trigger both sensors receive a more extensive spray through both nozzles. This targeted spraying method reduces pesticide wastage and minimizes soil and air pollution.



Priyanka MN
7th Class

Solution: The robot's movement is controlled via an Android mobile device using the Bluetooth RC controller app. The mobile device communicates with the robot's Bluetooth module, which is connected to a microcontroller. By pressing specific buttons on the app, the user can easily control the robot's movement, such as moving it forward or backwards.

(Source: INSPIRE MANAK NLEPC 2023 Booklet)

Sitting Device for Disabled Person

Purvi Tibra observed the lack of awareness and resources available for children with cerebral palsy (C.P.) in India. Recognising that three out of every 1,000 children in the country suffer from C.P., Purvi was inspired to develop a device that addresses multiple challenges faced by these children. Existing devices and assistive tools are often inaccessible or prohibitively expensive, making treatment unaffordable for many families.

Problem: This lack of availability and affordability motivated her to design a multi-functional device that assists C.P. children not only in sitting but also in exercising, feeding, and promoting motor and sensory development.



Purvi Tibra
7th Class



Solution: The innovation aims to support physiotherapists, parents, and caregivers, providing a practical, affordable solution for those who cannot afford therapy expenses or lack access to therapy services in their area. By developing this device, Purvi seeks to bridge the gap in resources and support for C.P. children, ultimately enhancing their overall well-being and quality of life. Affordability motivated her to design a multi-functional device that assists C.P. children not only in sitting but also in exercising, feeding, and promoting motor and sensory development.

(Source: INSPIRE MANAK NLEPC 2023 Booklet)



Cover Story

Sustainable Development Goals

Have you ever looked around your neighbourhood and wondered how we can fix the big, messy problems we see every single day? Problems like piles of plastic waste on the streets, lakes choked with dirty water, or the intense summer heatwaves that seem to get worse every year. Sometimes, these challenges feel so massive that it seems impossible for one person, or even one country, to solve them.

But here is an incredible secret: the world actually has a shared master plan to fix them. When you first discover this plan, it feels like finding a treasure map for the planet. In 2015, leaders from almost every country on Earth came together at the United Nations. They realized that global challenges like poverty, pollution, and climate change are all connected.

So, they created a defined, step – by – step list of targets called the **Sustainable Development Goals (SDGs)**, also known as the 2030 Agenda.

There are exactly 17 of these goals, backed by 169 specific targets, and they represent the ultimate roadmap to build a cleaner, fairer, and safer planet by the year 2030. For high school students and teachers in India, this isn't just a list of global rules. It is a massive, real – world science sandbox where today's curiosity transforms into tomorrow's life – changing innovations.

What Exactly Are the SDGs? The 17 Goals Explained

In the simplest terms, sustainable development means living our lives and building our world in a way that improves life today without destroying the environment for the people who will live here tomorrow.

Let us break down the 17 goals into simple, bite – sized ideas so we can see what the global community is working toward:

- **Goal 1: No Poverty** – Ending poverty everywhere so every human being has basic needs like food, shelter, and clothing.
- **Goal 2: Zero Hunger** – Improving agriculture and ensuring that no child goes to bed with an empty stomach.
- **Goal 3: Good Health and Well-being** – Wiping out deadly diseases, improving mental health, and making healthcare affordable.
- **Goal 4: Quality Education** – Ensuring every boy and girl has access to free, excellent schooling and lifelong learning.
- **Goal 5: Gender Equality** – Providing equal opportunities, safety, and respect for women and girls everywhere.
- **Goal 6: Clean Water and Sanitation** – Ensuring safe, affordable drinking water and clean toilets for every community.
- **Goal 7: Affordable and Clean Energy** – Shifting away from polluting fossil fuels to clean options like solar and wind power.
- **Goal 8: Decent Work and Economic Growth** – Creating good jobs and safe working spaces that help economies grow sustainably.
- **Goal 9: Industry, Innovation, and Infrastructure** – Building strong bridges, safe roads, and supporting new scientific inventions.
- **Goal 10: Reduced Inequalities** – Closing the massive gap between the rich and the poor, and treating everyone fairly.
- **Goal 11: Sustainable Cities and Communities** – Designing clean, safe cities with smart public transport and green spaces.
- **Goal 12: Responsible Consumption and Production** – Reducing waste, cutting down on plastic usage, and recycling what we use.
- **Goal 13: Climate Action** – Taking urgent steps to reduce greenhouse gases and combat global warming.
- **Goal 14: Life Below Water** – Protecting our oceans, seas, and marine life from plastic pollution and overfishing.
- **Goal 15: Life on Land** – Planting trees, stopping deforestation, and protecting endangered wild animals.



- **Goal 16: Peace, Justice, and Strong Institutions** – Stopping violence, ensuring fair laws, and building honest leadership.
- **Goal 17: Partnerships for the Goals** – Encouraging countries, schools, and organizations to work together to achieve the first 16 goals.

The Ultimate Chain Reaction: How the Goals Are Interconnected

One of the most fascinating aspects of the SDGs is that they are not isolated boxes. They are like a row of falling dominoes. When you work on solving one goal, you automatically start fixing several others. But if you ignore one, new problems crop up instantly.

Consider a simple, everyday resource: **Clean Water (SDG 6)**. Did you know that India loses roughly 40% of its treated water due to underground pipe leakages and daily wastage? When a community lacks clean water, it triggers a terrible chain reaction:



Now, look at the positive side. If we use science to install a low – cost water purification system in a village, the dominoes fall in the opposite direction! Diseases drop (**SDG 3**), children stay healthy enough to attend school regularly (**SDG 4**), and girls do not have to walk hours to fetch water, giving them an equal shot at a bright future (**SDG 5**).

Climate Action (SDG 13) acts as the ultimate master link. When global temperatures rise and rainfall patterns turn chaotic, it severely disrupts our agricultural systems. Unpredictable monsoons lead to immediate crop failures, which create severe food shortages (**SDG 2**).

When farmers lose their crops, their livelihoods vanish, throwing families right back into financial stress (**SDG 1**).

The message is incredibly clear: problems in the real world are not isolated chapters in a textbook. They are part of a living, breathing ecosystem.



Activating the Plan: Bringing the Goals into the Classroom

Understanding this interconnected ecosystem helps us realize that the science we learn on paper is the exact tool we need to fix the planet. The SDGs give us a direct reason to apply our education. Instead of viewing physics, chemistry, and biology as separate textbook chapters to memorize, we can start viewing them as practical instruments designed to solve these exact global targets.

For instance, the physics behind how solar panels absorb light maps straight to **SDG 7 (Clean Energy)**. The chemistry of greenhouse gases directly helps us address **SDG 13 (Climate Action)**. Even basic biology lessons on how bacteria break down organic waste become the foundation for designing biodegradable packaging to meet **SDG 12 (Responsible Consumption)**. By viewing our school curriculum through the lens of the SDGs, classroom education transforms from static facts into a powerful, live - action toolkit.

Case Studies: Incredible Indian Innovations

You do not need an advanced laboratory or a multimillion - dollar budget to make a profound difference. Across India, simple, practical ideas are creating massive changes right now, proving that grassroots innovation is our strongest asset.

1. The Barefoot College (Rajasthan)

In the dry, rural regions of Rajasthan, an extraordinary organization called Barefoot College runs a beautiful program. They take rural women - many of whom have never had the chance to go to school or learn to read - and train them to become fully qualified solar engineers.

These women learn to assemble, install, and repair solar lighting systems using colour - coded tools and visual charts. They have brought clean light to thousands of remote homes, beautifully hitting **SDG 7 (Clean Energy)** and **SDG 5 (Gender Equality)** in one move.



2. Sulabh International

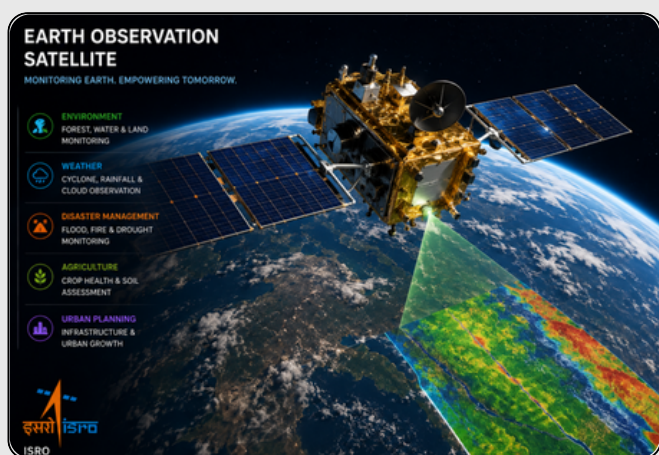
Sanitation was one of the biggest health hazards in India for decades. Sulabh International completely revolutionized public health by designing highly affordable, eco-friendly, two -pit pour - flush compost toilets.



This simple engineering invention stopped the spread of deadly waterborne diseases, cleaned up public spaces, and restored safety and human dignity to millions of citizens (**SDG 6 and SDG 3**).

3. Space Science for Farmers

The Indian Space Research Organisation (ISRO) doesn't just launch rockets for show. They use their specialized satellites orbiting high above the Earth to track crop health, predict weather changes, and map water resources. This vital satellite data is shared directly with local farmers, allowing them to know exactly when to water their fields or spray crops, securing our food supply (**SDG 2**).



Learning Environment Spotlight: The "Idea Lab" Routine

How can classrooms transition from just talking about these 17 goals to actively working on them?

Teachers and students can easily transform any standard science period into a **Headline - to - Harvest Innovation Space** using an elegant, four-step routine that takes very little time.

Step 1: The Local Observation Focus

Instead of looking at massive global maps, focus on your immediate surroundings. Look at your school campus, your street, or your home. What is one specific thing that looks wasteful or broken? Is the school canteen throwing away heaps of food scraps? Are the lights left running in empty rooms?

Step 2: The SDG Mapping Challenge

Once you identify a local problem, map it to the global goals. If the school generates massive amounts of organic food waste, that links directly to **SDG 12 (Responsible Consumption)**.

Step 3: The System Brainstorm

This is where the class puts on their collective scientific hats. The teacher guides a quick, focused discussion using three core questions:

- Why is this problem happening here? (Root Cause Analysis)
- What are the underlying scientific principles involved? (Textbook Connection)
- What is a low - cost, immediate way to change this habit? (Practical Solution)

Step 4: The School Newsboard

Instead of writing a long, boring essay, draw a simple, bold poster or visual chart explaining your solution. Pin it up on a central school "Newsboard" or share it during class presentations. When an entire school starts seeing their daily environment through the lens of the SDGs, the school campus itself turns into a living laboratory for sustainable progress.

Future Careers: The Green Pioneers

We can all contribute to the SDGs in our everyday small deeds, like switching off an idle fan or reducing single – use plastics. However, there are also many incredible career opportunities for the passionate ones to make a living while making a real difference.

India's growing focus on sustainability is creating rapidly expanding fields where professional paths are entirely centered around solving global challenges. Here are a few paths you can explore:

- **Renewable Energy Engineer:** Focuses on designing advanced solar grids, wind turbines, and long – lasting storage batteries to bring clean power to every corner of the country (**SDG 7**).
- **Sustainable Agricultural Technologist:** Uses automated drones, smart moisture sensors, and natural farming methods to grow more food using less water and land (**SDG 2**).
- **Smart Urban Planner:** Designs the eco-friendly cities of tomorrow by setting up efficient waste recycling systems, clean electric public transport routes, and building green spaces (**SDG 11**).
- **Green Materials Scientist:** Focuses on chemistry and material design to invent completely compostable alternatives to single – use plastics out of natural plant fibres (**SDG 12**).
- **Environmental Data Analyst:** Uses computer software, maps, and satellite feeds to track global climate shifts, map forest cover, and monitor endangered wildlife populations (**SDG 13 & SDG 15**).

Future Vision: A Peek into 2030

Close your eyes for a moment and imagine waking up on a morning in the year 2030, in a world where the SDGs have been successfully achieved.

You walk outside, and the air is crisp, fresh, and completely free of thick smog because the public buses and trains run entirely on clean electric power. The rivers running through our towns are sparkling clean, filled with fish, and completely free of plastic trash.

Your school runs completely on solar power generated right on the roof, and lessons are learned through hands – on, interactive regional projects. In rural areas, every home has stable power, clean drinking tap water, and digital learning tools. Forests are growing back, oceans are healing, and every single child has a seat in a warm, welcoming classroom.

This incredible future is not a far – fetched sci-fi movie. It is a completely achievable reality. But it doesn't happen by magic. It depends entirely on the small, curious actions we take inside our homes and classrooms today.

By observing your surroundings, questioning wasteful habits, and using your school lessons to design smart solutions, you stop being a passive spectator.

You become an active change – maker. Organisations like the GETA Service Trust are always looking out for young minds who dare to look at a problem and see an opportunity to innovate. The journey toward a brilliant 2030 starts with your curiosity, so let us open our eyes, look at the world around us, and start building our future today!

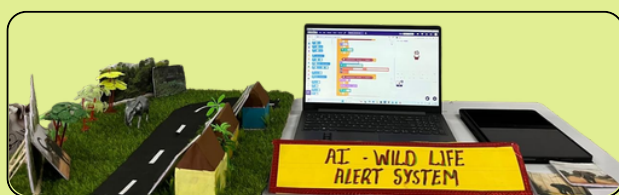
AI Wildlife Alert System

The AI Wildlife Alert System uses AI-based image classification to detect wild animals near villages, farms, and forest borders. It sends alerts to residents and authorities, helping prevent human-wildlife conflict safely and effectively.

Problem: Wild animals entering human settlements can damage crops and property while posing risks to people and wildlife. Existing prevention methods are often costly and ineffective.



Fathima Minha
7th Class



Solution: Using cameras and PictoBlox AI, the system identifies animals like elephants in real time. It sends instant alerts and safely guides animals away without harm, protecting both communities and wildlife.

[Link for the project's video presentation](#)
[YouTube.com/@GETAYoungScientist](https://www.youtube.com/@GETAYoungScientist)

(Source: GYS Avishkar Awards 2025 Booklet)

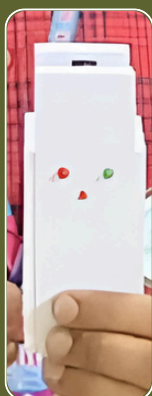
Smart Biodegradable Detector

The Smart Biodegradable Food Wrapper Detector is a low-cost device that quickly identifies whether plastic wrappers are biodegradable or non-biodegradable using IR sensors and Arduino Nano technology.

Problem: Non-biodegradable plastic wrappers pollute soil, water, and air for centuries, creating serious environmental problems. Existing testing methods can be slow and complex.



Rishi Pratti
8th Class



Solution: The system uses an IR LED transmitter, TSOP sensor, and Arduino Nano to detect wrapper type. A green LED indicates biodegradable packaging, while a red LED signals harmful non-biodegradable plastic. The device is portable, fast, and requires no chemical testing.

[Link for the project's video presentation](#)
[YouTube.com/@GETAYoungScientist](https://www.youtube.com/@GETAYoungScientist)

(Source: GYS Avishkar Awards 2025 Booklet)

NML – National Metallurgical Laboratory

The National Metallurgical Laboratory (NML) is one of India's oldest CSIR laboratories, located in Jamshedpur, Jharkhand. Established in 1950, it is dedicated to research in metallurgy, minerals, and materials science, supporting India's industrial growth and technological advancement.



Objectives of NML

Conduct fundamental and applied research in metallurgy and materials science. Develop new alloys, steels, and advanced materials for defence, aerospace, automotive, and energy sectors. Provide industrial consultancy, testing, and technology transfer.

Support national missions like Make in India and Innovate in India. Promote **green metallurgy** and sustainable resource utilisation.

Achievements

Developed special steels and alloys for defence, aerospace, and automotive industries. Pioneered corrosion science and Remaining Life Assessment (RLA) of industrial components. Established pilot plants for mineral beneficiation and metallurgical processes.

Awards & Recognitions

Scientists at NML have received Shanti Swarup Bhatnagar Prizes and other national awards. Recognised for technology transfer and industrial consultancy. Commended for contributions to India's steel industry and defence sector.

Contributions

Strengthened India's steel and metallurgical industries since independence. Supported energy, infrastructure, and defence sectors with advanced materials.

Played a key role in industrial problem-solving through consultancy and testing. Advanced corrosion prevention and failure analysis techniques for critical components.

Future Directions

Research in nanomaterials, advanced alloys, and sustainable metallurgy. Support India's energy, defence, and infrastructure sectors with innovative materials. Expand industry partnerships for technology transfer and commercialisation. Contribute to circular economy and green metallurgy initiatives.

Conclusion

NML has played a vital role in India's industrial and scientific development through its contributions to materials research, alloy development, corrosion studies, and failure analysis. Its work has strengthened key industries, while its focus on sustainable and green metallurgy continues to support future technological advancements.

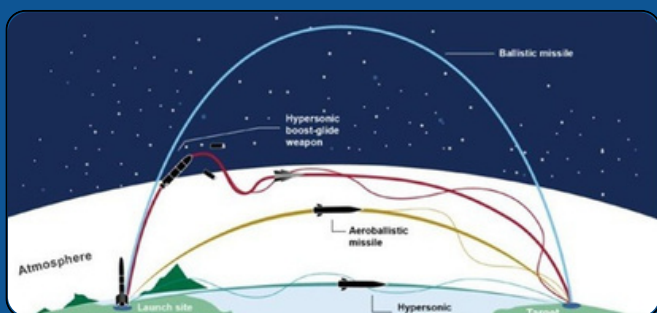


Indian Inventions

BrahMos

Supersonic Cruise Missile

Imagine a missile so fast that it travels **three times the speed of sound**, accurately hitting its target within minutes. That is the power of the **BrahMos Supersonic Cruise Missile**, one of the fastest operational cruise missiles in the world.



Developed through a collaboration between India and Russia, BrahMos represents a perfect blend of physics, engineering, and innovation. For students, it is not just about defence, it is about understanding how science is applied to solve real - world challenges.

What is BrahMos?

BrahMos is a **supersonic cruise missile** capable of:

- Flying at speeds of **Mach 2.8–3.0**
- Carrying conventional warheads
- Launching from land, sea, air, and submarines.



It is named after two rivers:

- Brahmaputra (India)
- Moskva (Russia)

Why is it important?

Modern defence requires:

Speed - Accuracy - Reliability

BrahMos provides:

- Quick response capability
- High precision strikes
- Strong deterrence

Key Features

- Supersonic speed
- Precision targeting
- Multi-platform launch capability
- Fire - and - forget system

Where is it used?

BrahMos is deployed in:

- Indian Army (land systems)
- Indian Navy (warships)
- Indian Air Force (air - launched version)

When was it developed?

- Joint venture established in **1998**
- Successfully tested multiple times since the early 2000s

Who developed it?

Developed by:

- **Defence Research and Development Organisation (DRDO)**
- Russia's NPO Mashinostroyenia



Why India Needs BrahMos?

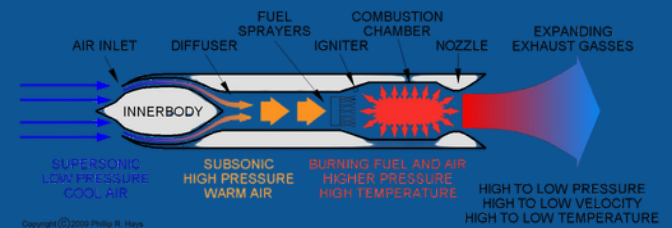


Challenges in defence systems and India's physiology

- Slow response time
- Inaccurate targeting
- Difficulty in interception
- Long coastlines
- Strategic borders
- Growing security needs

Fast and accurate systems are essential.

Definitions



1. Supersonic Speed

Speed greater than the speed of sound (~1235 km/h)

BrahMos travels nearly **3 times faster**.

2. Cruise Missile

A missile that:

- Flies at low altitude
- Uses jet engines
- Is guided throughout its path

3. Ramjet Engine

A type of engine that:

- Uses incoming air for combustion
- Works efficiently at high speeds

4. Mach Number

- Mach 1 = speed of sound
- Mach 3 = three times the speed of sound

Variants

- Land-based
- Ship-based
- Air – launched (from Su-30MKI)
- Submarine – launched



How It Works: Methods & Procedures

Step – by – Step Process

1. Launch from platform
1. Booster accelerates missile
1. Ramjet engine takes over
1. Cruise phase at supersonic speed
1. Terminal guidance to target

Guidance System

- GPS – based navigation
- Inertial navigation system (INS)
- Active radar homing

- Thrust generated by combustion
- Aerodynamic design reduces drag
- High kinetic energy ensures impact

Real – Life Connection

While BrahMos is a defence system, the science behind it is used in:

- Aviation technology
- Rocket science
- GPS navigation
- Materials engineering

Advantages of BrahMos

- Extremely fast
- High accuracy
- Difficult to intercept
- Versatile deployment
- Indigenous defence technology
- Engineering innovation
- Career opportunities in aerospace

Limitations of BrahMos

- Expensive
- Requires advanced technology
- Limited payload compared to slower missiles

Impact Created

- Strengthens national security
- Promotes indigenous technology
- Inspires students in STEM



DIY Activities for Students

Project Ideas

1. Build a **model rocket**
2. Study **aerodynamics using paper planes**
3. Design a **guidance system concept**

Classroom Activity for Teachers

Teachers can ask students engaging questions such as

- How can we reduce air resistance?
- What materials can withstand high temperatures?
- Can we develop reusable missile systems?

Conclusion

BrahMos is not just a missile, it is a symbol of **scientific excellence and innovation**.

It shows that:

- Science has real – world applications.
- Engineering solves complex problems.
- India can lead in advanced technology.

As one of the fastest supersonic cruise missiles in the world, it reflects the nation's progress in indigenous defense innovation and advanced engineering.

Word Search 2606 - Science of Space



TELESCOPE
WHITE DWARF
DARK ENERGY
WAVELENGTH
SUPERNOVA
GALAXY
PARALLAX
SPECTROGRAPH
BLACK HOLE
DARK MATTER
NEUTRON STAR
SPECTRUM
NEBULA
MAIN SEQUENCE
CONVEX LENS
PULSAR
PROTOSTAR
QUASAR

(Answers on Back Cover Inside)

Introducing Orchidarium In Schools

School Orchidariums are rooftop spaces designed to grow and display orchids while helping students learn about orchid conservation, cultivation, and biodiversity through practical experience.

Problem: Despite Arunachal Pradesh having rich orchid diversity, many students lack awareness and hands-on knowledge about orchid species, conservation, and their cultural importance.



Tungnya Hallang
9th Class

Solution: The project proposes rooftop Orchidariums in schools where students can grow and maintain orchids, learn about pot mixtures and cultivation methods, and document different species. This promotes biodiversity conservation, traditional knowledge, and opportunities for orchid-based livelihoods.



[Link for the project's video presentation](#)
[YouTube.com/@GETAYoungScientist](https://www.youtube.com/@GETAYoungScientist)

[\(Source: GYS Avishkar Awards 2025 Booklet\)](#)

Powerless Speaker

The "Powerless Speaker" is an eco-friendly device that amplifies mobile phone sound using a bamboo tunnel and tin containers without electricity. It is low-cost, sustainable, and made from waste materials.

Problem: In areas with limited or no electricity, people often cannot use electronic speakers for entertainment or group listening, especially in rural communities.



Ihina Lingi
10th Class



Solution: The device uses bamboo, tin containers, and aluminum foil to amplify sound through multiple reflections. Made from recycled materials, it provides louder audio from mobile phones without requiring power, making it useful and affordable for rural areas.

[Link for the project's video presentation](#)
[YouTube.com/@GETAYoungScientist](https://www.youtube.com/@GETAYoungScientist)

[\(Source: GYS Avishkar Awards 2025 Booklet\)](#)

Indian Scientist

Tessy Thomas

Padma Shri (2012)



(Born On April 1963)

Dr Tessy Thomas, popularly known as the **"Missile Woman of India,"** is a distinguished Indian scientist from Alappuzha, Kerala. Inspired by nearby rocket launches, she pursued Electrical Engineering, followed by an M.Tech in Guided Missile Technology from DIAT, Pune, and a PhD in Missile Guidance from JNTU, Hyderabad.

Agni Missile Program: Served as Project Director for Agni - IV and Associate Project Director for Agni - V, leading the development and successful testing of India's long - range ballistic missiles.

Guidance & Navigation: Advanced missile guidance, control, navigation, and re - entry technologies, significantly improving missile accuracy and reliability.

Propulsion Systems: Contributed to the development of indigenous solid propulsion systems, strengthening India's missile technology.

Strategic Defence: Played a key role in enhancing India's self - reliance in missile technology and strengthening its strategic defence and nuclear deterrence capabilities.

Major Awards and Recognitions

- Padma Shri (2012) for contributions to India's missile technology.
- DRDO Scientist of the Year Award (2008) for leadership in missile development.
- Lal Bahadur Shastri National Award (2012) for excellence in science and public service.
- Dr Paulos Mar Gregorios Award (2025) for contributions to missile technology and women's empowerment.
- IEEE Women in Engineering Award and INAE Fellowship for scientific excellence.
- Space Pioneer Hall of Fame (2014) - First Indian woman inducted for contributions to missile science.

Other Honors

Recognised globally as a role model for women in STEM, featured by the **BBC** and **UN Women**, and frequently invited to deliver keynote addresses at international aerospace and defence conferences.



Legacy and Inspiration

Dr Tessy Thomas broke gender barriers in defence science, strengthened India's self - reliance in missile technology, and continues to inspire young scientists, especially women, to pursue careers in engineering and research.



Innovation Training **Module**

Rethink, Reuse, Reimagine

The Science of Sustainable Consumption

Look Around You

Take a moment and look around your room or classroom.

How many objects do you see?

A notebook.

A pen.

A water bottle.

A school bag.

A chair.

A mobile phone.

A textbook.

Now ask yourself: Where did these things come from?

Every product we use requires raw materials, energy, transportation, manufacturing, and packaging.

Most people see only the final product.

Innovators think about the entire journey.

The Hidden Story Behind Everyday Objects

A simple notebook requires:

- Trees for paper.
- Water for processing.
- Energy for manufacturing.
- Fuel for transportation.



When we waste paper, we are not only wasting a notebook. We are wasting all the resources used to create it.

This idea lies at the heart of Sustainable Development Goal 12: Responsible Consumption and Production.

Why Sustainability Matters

The Earth has limited resources, but human consumption continues to grow.

Every year:

- Millions of tonnes of plastic enter the oceans.
- Food is wasted while people go hungry.
- Valuable materials end up in landfills.

The challenge is not only producing more.

The challenge is producing and consuming more responsibly.

Innovation Through Circular Thinking

Traditionally, products follow a simple path:

Make → Use → Throw Away

Sustainable innovators follow a different model:

Make → Use → Reuse → Repair → Recycle

This is known as the Circular Economy.

Instead of treating waste as garbage, it treats waste as a resource.

Innovation Spotlight

Students around the world are creating exciting sustainability solutions:

- Eco - bricks made from plastic waste.
- Notebooks created from recycled paper.
- Furniture made from discarded materials.
- Apps that reduce food waste.
- Reusable packaging systems.

Many successful startups began with a simple question.

“Why are we throwing this away?”

Activity: Waste to Wonder

Collect safe waste materials such as:

- Cardboard
- Plastic bottles
- Newspaper
- Packaging material

Design a useful product from these items.

Examples...

- Desk organiser
- Bird feeder
- Mobile stand
- Plant holder

The goal is not art.

The goal is problem – solving.

Think Like an Innovator

When designing your solution, ask...



- What problem does it solve?
- What waste material is being reused?
- How many people can benefit?
- Can it be scaled?

The best innovations create both environmental and social impact.



Challenge for Young Innovators

Conduct a “Waste Audit” of your classroom.

Observe:

- How much paper is discarded?
- How much plastic enters the classroom daily?
- Which materials could be reused?

Based on your findings, propose one practical solution.

Reflection

The future will not be built by people who consume the most.

It will be built by people who use resources wisely.

Every sustainable innovation begins when someone looks at waste and sees a possibility.

Innovation Question

What product used in your school today could be redesigned to create less waste tomorrow?

M. R. Srinivasan

Padma Shri (1984) - Padma Bhushan (1990) - Padma Vibhushan (2015)



(5 January 1930 – 20 May 2025)

Malur Ramasamy Srinivasan was one of India's foremost nuclear scientists and mechanical engineers. He pioneered India's **Pressurised Heavy Water Reactor (PHWR)** technology and played a pivotal role in making the country self-reliant in nuclear power.

Born in Bangalore, he earned a B.E. from University Visvesvaraya College of Engineering and later completed his M.Sc. and Ph.D. in Gas Turbine Technology from McGill University.

Scientific Contributions

Foundation of India's Nuclear Program:

Joined the Department of Atomic Energy (1955) and worked with Homi J. Bhabha on Apsara, India's first nuclear research reactor.

Engineering Leadership: Led the development of India's first atomic power station and the Madras Atomic Power Station (1967).

Pressurised Heavy Water Reactor (PHWR):

Led the design and deployment of PHWR technology, which became the backbone of India's nuclear power program.

Leadership: Served as Director of the Power Projects Engineering Division, Chairman of the Nuclear Power Board, Chairman of the Atomic Energy Commission, Secretary of the Department of Atomic Energy, and founding Chairman of NPCIL.

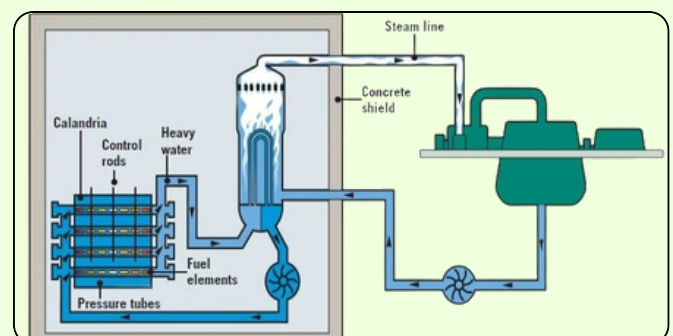
Global Contribution: Served as Senior Adviser to the International Atomic Energy Agency (IAEA), contributing to international nuclear policy and the peaceful use of nuclear energy.

Awards & Achievements

- **1984: Padma Shri** – For contributions to nuclear engineering
- **1990: Padma Bhushan** – For leadership in India's atomic energy program
- **2015: Padma Vibhushan** – India's second-highest civilian honour
- **1996: Om Prakash Bhasin Award** – For excellence in engineering and technology

Legacy

Dr. Srinivasan's legacy reflects scientific excellence, indigenous innovation, and dedicated national service. His leadership shaped India's peaceful nuclear program and inspired generations of scientists and engineers.





S&I Article

Digital Tools for Learning

Education today is no longer limited to chalkboards and textbooks. With the rapid growth of technology, digital learning tools have transformed how we understand concepts, explore ideas, and innovate solutions. These tools combine digital content with interactive technology, moving us away from passively reading textbooks into a world where we actively experiment with concepts.

Did You Know?

- **A Student Pool Larger Than the EU:** India has around 580 million people aged 5 to 24. That is the world's largest student - age population - larger than the entire population of the European Union!
- **Data at Your Fingertips:** India has reached over 950 million active internet users, enjoying some of the lowest mobile data costs globally.

This massive connectivity allows a student in a remote village to instantly access the exact same high - quality learning resources as a student in a major metro.

- **Coding as a Core Skill:** Coding is no longer just for software engineers; it is increasingly recognized as a foundational literacy skill for young minds, right alongside reading and writing.

When Did This Shift Happen?

While digital learning existed earlier, the transition accelerated significantly during the COVID - 19 pandemic, making online learning a necessity rather than an option.

What began as an emergency backup has since evolved into a permanent, highly advanced ecosystem.

The Digital Learning Ecosystem in India

India's digital education landscape has grown into a diverse, sophisticated environment.

Today, learning platforms broadly fall into three main categories:

1. Government - Led "One Nation" Platforms

The Government of India has built vast public digital infrastructures to ensure free, equal access to high - quality education:

- **DIKSHA (Digital Infrastructure for Knowledge Sharing):** Serving as the core ecosystem for school education, DIKSHA features curriculum - aligned lessons in over 35 Indian languages. It uses **Energised Textbooks** - physical books printed with special QR codes. When scanned with a smartphone, these codes instantly unlock video lessons, animations, and practice sheets directly related to that specific topic. The interface also includes features like **"Ask DIKSHA,"** an intelligent AI learning assistant that gives students guided concept support right within the platform.
- **SWAYAM & SWAYAM Prabha:** SWAYAM offers free online courses from high school up to university post - graduation.



For students living in remote rural areas with limited internet connectivity, **SWAYAM Prabha** beams high - quality educational programming 24/7 across dozens of direct - to - home (DTH) television channels.

2. Interactive Private Platforms (EdTech)

Private platforms like BYJU'S, PhysicsWallah, Vedantu, and Khan Academy India offer hyper - personalised, adaptive learning experiences.

These systems use machine learning algorithms to map a student's strengths and weaknesses, tailoring practice quizzes and video paces to individual learning speeds.



3. Creation and Creative Problem-Solving Tools

Digital learning isn't just about watching videos —it's about creating.

- Platforms like **Scratch** let students learn complex programming logic by dragging and dropping visual blocks to build custom games and animations.
- **Virtual Labs** allow students to simulate complex chemistry or physics experiments safely on a screen when physical laboratory apparatus is unavailable.



Future Careers and Opportunities

Digital learning is actively shaping the future of education and professional careers. Students who are comfortable with technology today will have an incredible advantage tomorrow in rapidly evolving fields like artificial intelligence, data science, software development, and digital design.

Beyond traditional tech fields, careers in educational technology (EdTech), online teaching, and digital content creation are growing exponentially. Students can even become innovators by developing their own apps or digital solutions to solve local issues. With the rise of remote work and global collaboration, mastering these digital skills early is becoming absolutely essential for success in any field.

Navigating the Challenges

While technology bridges geographical gaps, a few obstacles remain. The **digital divide** means that not every student has independent access to high - speed devices or steady electricity. Furthermore, managing excessive screen time is crucial to preventing eye strain and ensuring healthy physical activity. The goal is a healthy **blended learning** approach, combining the best of classic, physical classroom interaction with the boundless power of digital tools.

DIY Activities: Become an Innovator Today!

You don't need a high - tech laboratory to start exploring digital tools. Try these simple tech challenges on a computer or smartphone:

- **Code a Story:** Hop onto the free Scratch platform and code a 1 - minute animated story explaining a scientific concept, like the water cycle or photosynthesis.
- **Be a Digital Creator:** Pick a topic you love, research it online, and record a short, 2 - minute educational video using a smartphone. Explaining a concept out loud to a camera is one of the best ways to master it yourself!
- **Build a Basic Webpage:** Use free online HTML tutorials to design a basic personal webpage showcasing your school projects or hobbies.

The Future Belongs to the Curious: Technology is your canvas. Use it to think critically, innovate fearlessly, and solve real-world problems!

Sudoku Challenge 2606

3	5	7			8			
	4			5				
		1	7					
	9				6		2	4
				9				
2	1		3				5	
					3	7		
				2			8	
			9			6	1	5

NPL – National Physical Laboratory

The National Physical Laboratory (NPL), located in New Delhi, is India's apex institution for physical sciences, measurement standards, and advanced materials research. Established in 1947 under the Council of Scientific & Industrial Research (CSIR), it is often called the "Timekeeper of India" for maintaining the nation's official time standards.



Objectives

Conduct fundamental and applied research in physical sciences. Develop and maintain national measurement standards (length, mass, time, temperature, etc.). Provide precision measurement, calibration, and testing services to industries. Advance research in materials science, nanotechnology, superconductivity, and quantum physics.

Achievements

Established India's national measurement standards, ensuring global compatibility. Developed atomic clocks and maintains Indian Standard Time (IST). Pioneered research in semiconductors, superconductors, and nanomaterials. Provides calibration services that ensure accuracy in manufacturing, trade, and industry. Contributed to solar energy materials, sensors, and advanced materials research.

Contributions

NPL serves as the backbone of India's metrology system, ensuring measurement accuracy across science and industry.

It supports sectors such as ISRO, DRDO, and defence through advanced materials, precision measurement technologies, quality certification, and research in quantum science and nanotechnology.

Awards & Recognitions

NPL scientists have received Shanti Swarup Bhatnagar Prizes and other national honours. Recognised globally for contributions to metrology and advanced materials research. Commended for supporting India's space program, defence technologies, and industrial standards.

Collaborations

National: Collaborates with ISRO, DRDO, IITs, and industries for precision measurement and materials research.

International: Works with global metrology institutes to align India's standards with international systems.

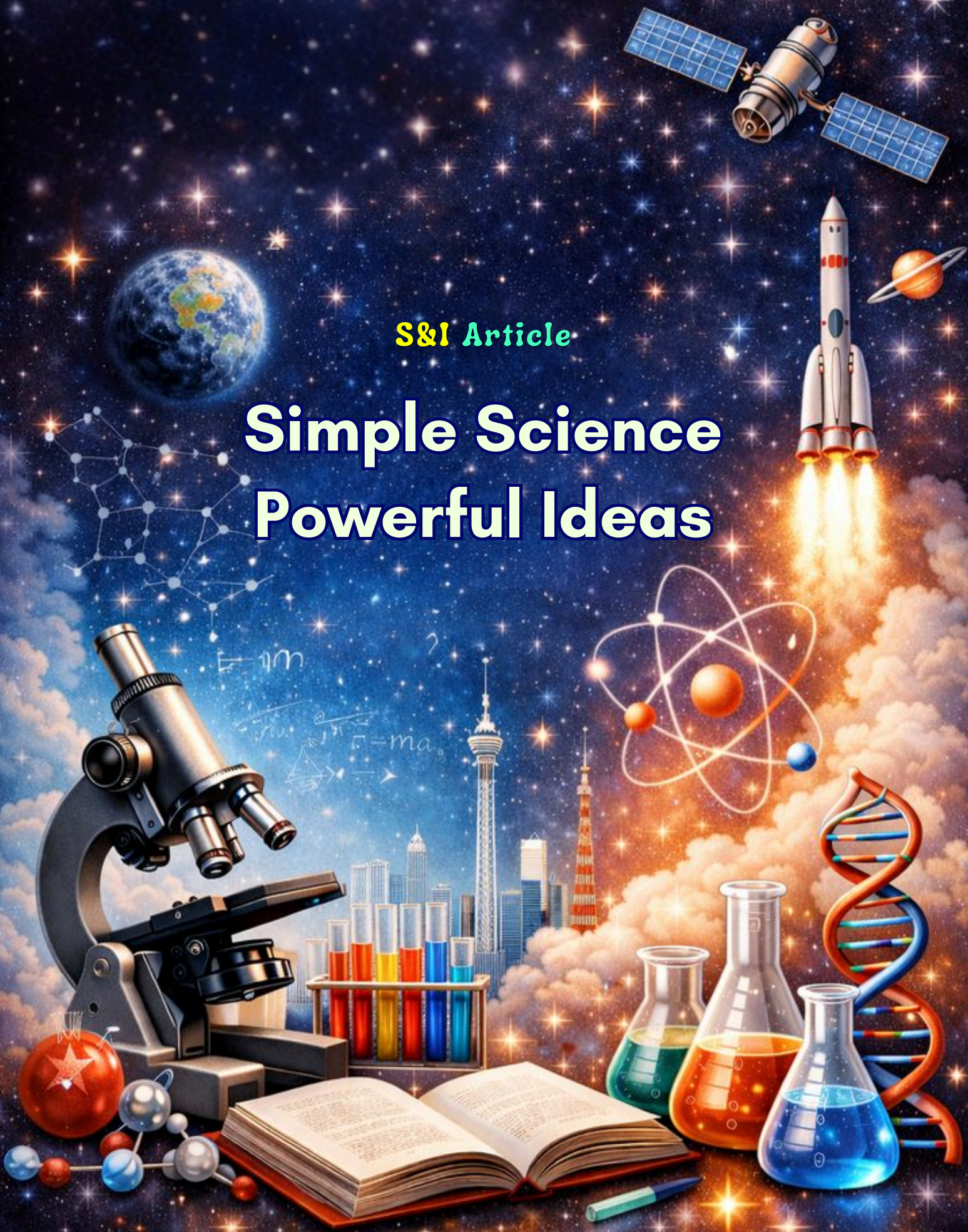
Conclusion

NPL is India's premier institute for measurement science and physical research, maintaining national standards of precision and accuracy.

It plays a key role in advanced materials, quantum technologies, and scientific innovations that support industry, defence, and national development.

S&I Article

Simple Science Powerful Ideas



When we imagine science, we often think of difficult formulas, vast laboratories, and expensive machines. But look closer. The most revolutionary ideas in science are often elegantly simple, rooted not in complexity, but in profound, persistent curiosity about the world we see every day.

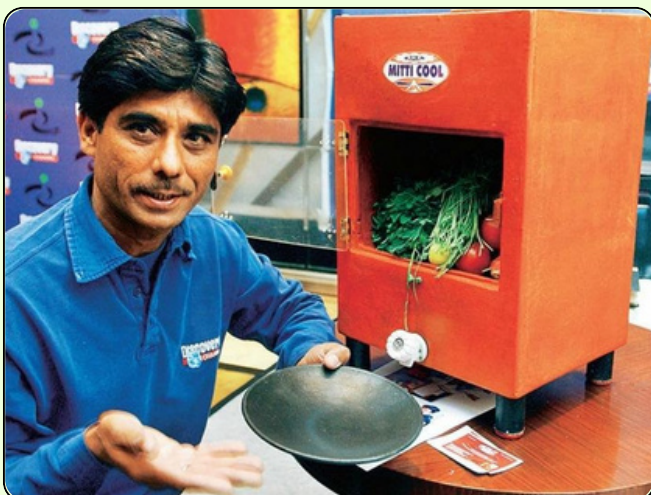
The Spark of Everyday Curiosity

Think of an apple falling. It is a mundane sight, yet it led to the grand concept of gravity. Consider a plant stretching toward the light. Behind that daily process is phototropism, which explains how life adapts to energy. Simple science is not just an explanation; it is an invitation to innovate.

Why Simple Science Matters

Innovation does not always demand complex code or multi - million dollar equipment. It often starts with a single, simple question: Why does this happen, and can I improve it?

This matters because impactful innovation is highly accessible. It can happen anywhere - in homes, schools, farms, and especially in communities where resources are scarce. The goal is to connect these fundamental principles to tangible problems.



From Concept to Impact: Real-World Examples

Scientific concepts are the ultimate building blocks. Understanding how something works, even on a basic level, provides the creative freedom to apply that knowledge in completely new ways. Here is how simple, everyday principles have been transformed into powerful, real - world breakthroughs in India:

- **The Power of Evaporation (Mechanics):** We know that heat drives evaporation, and evaporation creates a cooling effect. Innovator Mansukhbhai Prajapati used this exact physics principle to create the **Mitticool refrigerator**. Built entirely from clay, it requires zero electricity, making safe food storage accessible to rural households using pure, simple science.
- **The Magic of Bending Light (Optics):** When light passes through dense materials like water, it bends - a concept known as refraction. In dark, dense urban settlements across India, the "**Litre of Light**" project uses this beautifully. Simple plastic bottles filled with water and bleach are fixed to tin roofs. They capture sunlight and refract it inside, lighting up dark rooms with the strength of a 55 - watt solar bulb for free.
- **Harnessing Gravity (Physics):** Gravity naturally pulls matter and water downward. By simply looking at this basic rule, urban and rural communities design **Rainwater Harvesting** networks. Catchment systems on rooftops utilize gravity to route water into deep underground aquifers, replenishing dried - up wells without a single electronic pump.

- **Optimising Capillary Action (Bio - Engineering):** Plants pull moisture upward through their roots using capillary action. Engineers and students are now using this concept to build **Green Infrastructure** in congested Indian cities. Vertical walls and rooftop gardens use automated capillary setups to keep plants thriving, which cools concrete buildings and naturally absorbs urban air pollution.

The Innovation Cycle: How the Magic Happens

The transition from a basic idea to a powerful innovation is a dynamic process. It begins with observing a problem, questioning why it persists, experimenting with what you have, and constantly improving. It is a cyclical process of learning by doing.

A lack of resources should never discourage you. Often, limitation is the mother of all invention.

While challenges like a fear of failure or a lack of sophisticated guidance exist, the biggest hurdle is simply starting. Every "failure" is just a normal part of the scientific method, teaching you exactly what didn't work and bringing you one step closer to the real solution.

Shaping the Problem-Solvers of Tomorrow

This capability to innovate using accessible science is vital for the future. It shapes career paths not just in traditional fields like medicine or engineering, but also by creating a new generation of problem - solvers.

India's future depends on social entrepreneurship, sustainable development, and affordable tech.

As young students, you are not just passive learners reading a magazine; you are the active creators who will build these solutions.



Did You Know?

Plants can track the sun throughout the day to maximise energy absorption. Imagine if solar panels were this smart without expensive sensors and motorised tracking gear. That's the genius of nature's simple physics!

Conclusion: Starting Small, Impacting Big

Simple science is powerful because it democratizes innovation.

It breaks down the laboratory walls, inviting everyone - including you - to look at the world around them as an open lab. The goal is not merely to learn facts, but to learn how to see and then how to solve.

You do not need an advanced degree or complex machinery. All you need is curiosity, determination, and the willingness to ask, "What if we try something different?" By embracing simple science, you step onto a path of dynamic problem - solving that can transform your community, and eventually, the world.

Drone – Based Medical Delivery Networks

Learning Through Technology

AI – powered crop disease detectors are not just tools for farming; they are also powerful learning systems. They continuously improve by analysing more data and learning from patterns.

For example, the system can identify early signs of disease that may not be visible to the human eye. It can suggest possible treatments or preventive measures.

How the Technology Spread Around the World?

As smartphones and internet access became more widespread, AI – based farming tools began reaching farmers across the globe. Many mobile applications were developed to help farmers simply take a picture of a plant and receive instant results.

Governments, agricultural organisations, and technology companies started promoting these tools to support farmers, especially in developing countries. Today, **AI – powered crop disease detectors** are used in countries like India, the United States, and China, helping farmers improve productivity and ensure food security.

Why AI – Powered Crop Disease Detectors are an Innovation?

This technology is a major innovation because it combines agriculture with advanced digital tools to solve real – world problems. It demonstrates several important ideas:

- Technology can improve **traditional practices**.
- Early detection can prevent major losses.
- Simple tools like smartphones can deliver **powerful solutions**.

Global Adoption

As drone technology advanced, governments and healthcare organizations worldwide began adopting it for medical deliveries. Today, countries such as **Rwanda, India, the United States, and Ghana** use drone networks to transport life – saving medicines and vaccines, particularly to remote and hard – to – reach communities.

Why Drone – Based Medical Delivery Networks are an Innovation?

This technology combines **healthcare, aviation, and digital systems** to enable faster deliveries, overcome geographical barriers, and make healthcare more efficient, accessible, and reliable.

Did You Know?

*Some medical drones can travel **over 100 km**, delivering life – saving supplies much faster than traditional transport.*

Conclusion

Drone – based medical delivery networks are making healthcare **faster, smarter, and more accessible** by delivering essential medical supplies quickly, especially to remote areas, shaping the future of healthcare services.

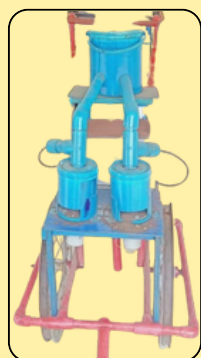
Smart Health Care

Krishna's idea aims to promote sustainable agriculture by encouraging the use of bio - farming techniques instead of excessive chemical fertilisers and pesticides. Inspired by the successful bio - farming model in Sikkim, the project focuses on improving farmers' health, protecting the environment, and supporting eco - friendly farming practices.

Problem: The excessive use of chemical fertilisers and pesticides in the agricultural lands of the Attabira block in Bargarh district has led to serious health issues, including cancer and kidney disease, among the local farming community. Although biofertilisers offer a safer alternative, farmers lack an efficient and practical system to apply them effectively in the fields.



Krishna Sahu
9th Class



Solution: To address this challenge, Krishna developed a smart agriculture healthcare system comprising three units: a storage unit, a control unit, and a dispenser unit. When activated, the rotating plate in the dispenser creates low air pressure, allowing biofertilizer from the storage unit to flow into the dispenser and be sprayed evenly. The spray distance and quantity can be adjusted using a lever and switch, enabling efficient application of biofertilizers while promoting healthier, sustainable, and environmentally friendly farming.

(Source: INSPIRE MANAK NLEPC 2023 Booklet)

Safety Clip

Mannat has designed a hairclip for girls and women with several unique safety features. The clip includes GPS tracking, the ability to remotely dial into the device and listen to the surroundings, and an SOS button that automatically calls a parent's number and records the conversation.

Problem: The idea was inspired by the increasing number of crimes against women, girls, and children, and Mannat's desire to contribute to their protection and safety. The hope is that the Raksha Clip can help prevent crimes, save lives, and support justice for victims of human trafficking and violence against women.



Mannat Bhargava
7th Class



Solution: The device is built with high - quality, durable materials to ensure reliability in critical situations. Its real - time GPS tracking allows for immediate location monitoring during emergencies, which can be crucial when every second counts. Overall, the Raksha Clip offers a much - needed layer of protection and has the potential to be a game - changer in the fight against human trafficking and gender - based violence, empowering women and enhancing their personal security.

(Source: INSPIRE MANAK NLEPC 2023 Booklet)

Indian Scientist

Gopinath Balakrish Nair

Shanti Swarup Bhatnagar Prize (1998)

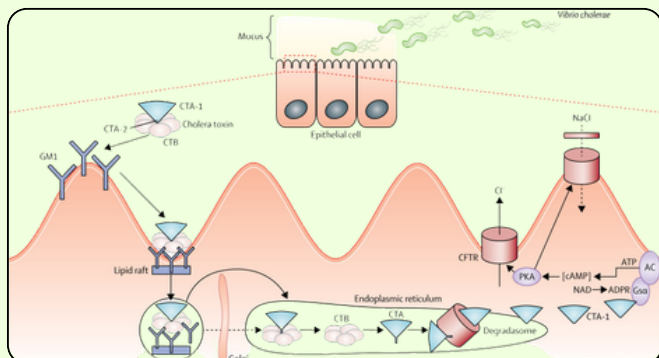


(Born On 5 January 1954)

Gopinath Balakrish Nair is a globally renowned Indian microbiologist known for his pioneering research on cholera and enteric bacterial diseases. He is one of the most influential scientists in infectious disease microbiology and public health, especially in developing countries. His work has significantly shaped modern understanding of *Vibrio cholerae*, the bacterium responsible for cholera, and helped improve disease surveillance, prevention, and treatment worldwide.

Major Scientific Contributions

- Discovered *Vibrio cholerae* O139 Bengal, revolutionizing global cholera research.
- Developed tools for outbreak surveillance and disease tracking.
- Authored 400+ scientific publications in microbiology and infectious diseases.



Leadership Roles

- Director, National Institute of Cholera and Enteric Diseases (NICED).
- Executive Director, Translational Health Science and Technology Institute (THSTI).
- Held senior leadership positions at the World Health Organization (WHO) and the International Centre for Diarrhoeal Disease Research, Bangladesh.

International Exposure

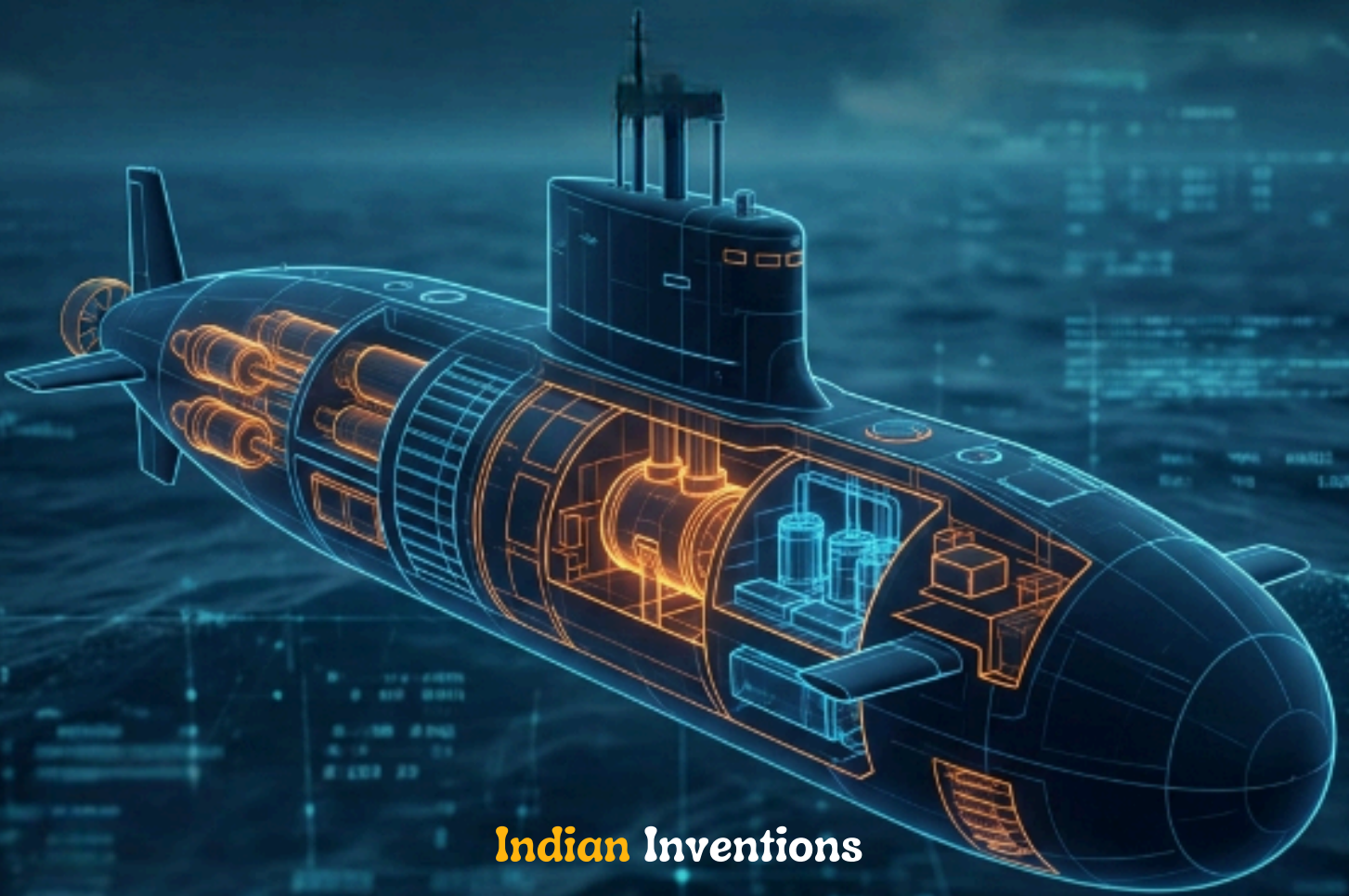
- Postdoctoral research in Japan on cholera toxins.
- Visiting scientist at Johns Hopkins University.
- Research collaboration in Canada and Kyoto University (Japan). This global exposure shaped his expertise in molecular microbiology and epidemiology.

Awards & Honours

- Shanti Swarup Bhatnagar Prize (1998) for the discovery of *Vibrio cholerae* O139.
- CDC Certificate of Merit (1994) and Prof. S.C. Mahalanobis Memorial Award (1998).
- Fellow of INSA, NASI, The World Academy of Sciences (TWAS), and Foreign Associate of the U.S. National Academy of Sciences.

Legacy & Inspiration

Dr. Gopinath Balakrish Nair revolutionized cholera research, strengthened global disease surveillance, mentored future scientists, and advanced India's leadership in infectious disease research.



Indian Inventions

Arihant Class Submarine Technology

Arihant is India's Underwater Powerhouse & the Science Beneath the Sea. They are the Silent Guardians of the Ocean.

Deep beneath the ocean surface, invisible to the human eye and almost undetectable by enemies, moves one of India's most powerful defence systems, the **Arihant Class Submarine**.

Unlike ships that sail on water, submarines operate **underwater for long durations**, carrying advanced technology and strategic capabilities.

India's first nuclear - powered submarine, INS Arihant, represents a major milestone in the country's scientific and technological journey. This is not just a military achievement, but in innovation, **engineering, and scientific excellence**.

What is a Submarine?

A submarine is a vessel that can:

- Operate underwater
- Control its depth
- Stay submerged for long periods

What is the Arihant Class Submarine?

The Arihant class is a group of:

- Nuclear – powered submarines
- Capable of launching ballistic missiles
- Designed for long – duration underwater missions

Fun Fact

Nuclear submarines don't need frequent refuelling



Why Does India Need It?

- Strengthens national security
- Provides second – strike capability
- Ensures strategic deterrence

It forms part of India's **nuclear triad** (land, air, sea defence systems).

Where is it Used?

- Deep oceans
- Strategic defence zones
- Coastal and international waters
- Surveillance
- Deterrence missions

Who Developed It?

Defence Research and Development Organisation, Indian Navy and Bhabha Atomic Research Centre

Do You Know?

Sound travels faster in water than in air

Challenges

- Surface ships are visible and vulnerable
- Enemy detection systems are advanced
- Long – distance strategic defence is required
- Need for stealth (invisibility underwater)
- Requirement of long – duration missions
- Dependence on foreign technology

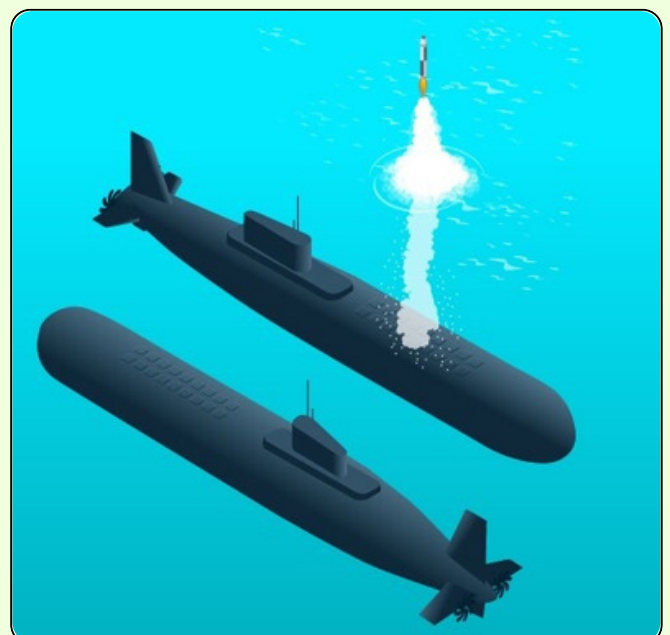
Develop an **indigenous nuclear submarine** that can:

- Stay underwater for months
- Avoid detection
- Carry strategic weapons

This leads to advancements in:

- Nuclear science
- Marine engineering

Defence technology



Scientific Concepts Behind Arihant

1. Buoyancy (Floating & Sinking)

Submarines use **ballast tanks**:

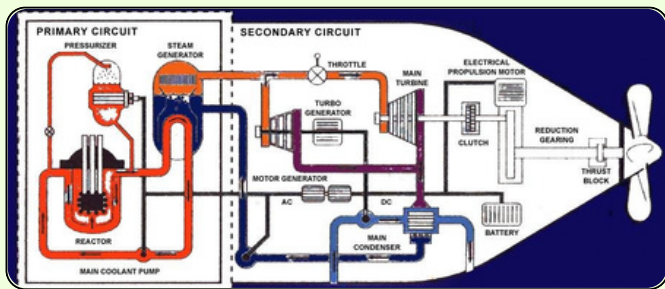
- Filled with water → submarine sinks
- Filled with air → submarine rises

This is based on Archimedes' Principle.

2. Nuclear Propulsion

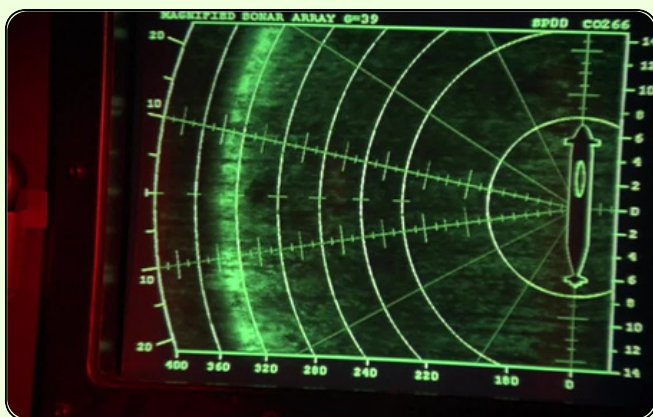
Instead of diesel engines, Arihant uses

- A nuclear reactor
- Generates heat → produces steam
- Drives turbines → moves submarine



3. Sonar Technology

SONAR = Sound Navigation and Ranging



- Uses sound waves
- Detects objects underwater

DIY Activity: Sound in Water

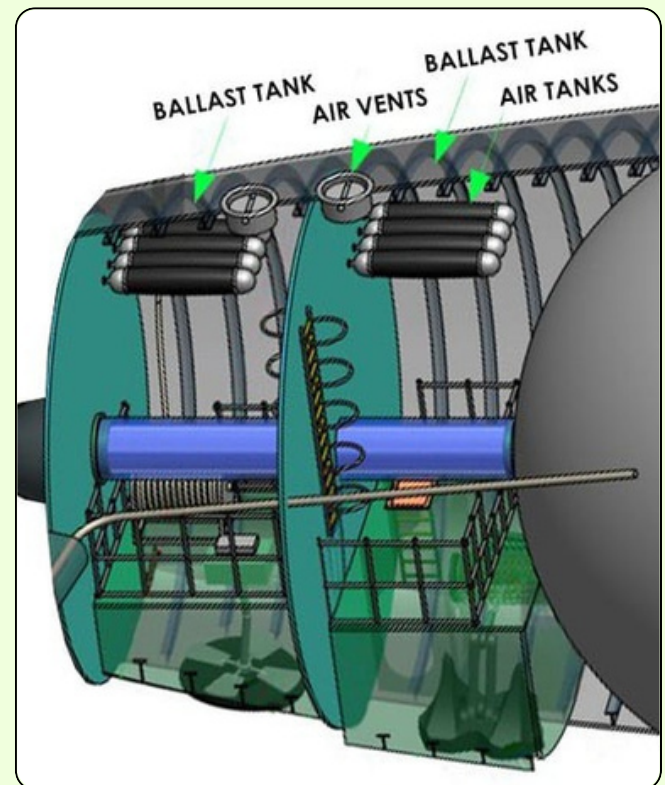
Tap two objects underwater and observe the sound transmission

4. Stealth Technology

- Special design reduces noise
- Makes the submarine hard to detect

How does it work?

1. **Submerge** using ballast tanks
2. **Navigate** using sonar and navigation systems
3. **Propel** using nuclear – powered turbines
4. **Communicate** using advanced systems
5. **Execute missions** stealthily



Answer in your own words?

- What is buoyancy?
- Why is stealth important?

Conclusion

Science Beneath the Waves. The Arihant – class submarine is a powerful example of how science works even in the deepest parts of the ocean.

URDIP - Unit for Research and Development of Information Products

CSIR - URDIP (Unit for Research and Development of Information Products), established under the Council of Scientific and Industrial Research (CSIR), is a specialised research unit located at Pune, Maharashtra. It strengthens India's innovation ecosystem by providing intellectual property (IP) support, patent analytics, and techno - commercial information services.

Acting as a bridge between science, technology, and industry, URDIP helps researchers, startups, and industries make informed decisions before beginning research and product development.

Objectives

URDIP provides value - added services in patent informatics, toxicology, phytochemistry, cheminformatics, and technology intelligence. It helps identify research gaps, innovation opportunities, and emerging technology trends while supporting product development, technology acquisition, and intellectual property management. It also conducts training programmes on patents, research planning, and innovation management.

Significance in Indian Research Space



URDIP plays a vital role in supporting startups, SMEs, industries, research institutions, and CSIR laboratories by providing patent intelligence and

technology landscape analysis. Its work promotes innovation, technology commercialisation, and evidence - based research, helping India compete in the global knowledge economy.

Collaborations

The institute collaborates with CSIR laboratories, universities, Indian industries, multinational companies, and academic institutions for joint research, training programmes, and knowledge - sharing initiatives.



Achievements

URDIP has established expertise in patent landscaping, competitive intelligence, and technology analysis. It has significantly contributed to drug discovery, herbal research, chemical safety studies, and the development of open-access knowledge databases and directories, making valuable scientific information accessible to researchers and innovators.

Future Vision

URDIP is advancing **AI - driven patent analytics**, supporting startups, expanding global collaborations, and strengthening India's innovation and intellectual property ecosystem.

Innovation Training Module

Innovating for Water Conservation



A Morning Without Water

Riya woke up one morning, rushed to the bathroom, turned on the tap... and nothing happened.

No water.

She tried again. Still nothing.

"Mom! There's no water!" she shouted.

Her mother replied calmly, "The supply has been cut for today. We'll have to manage with what we have stored."

Riya suddenly realised how difficult her day would be – no brushing properly, no long shower, no washing her favourite water bottle easily.

Later that day, her teacher shared something surprising.

"For many people around the world," the teacher said, "this is not just one day. This is their everyday life."

Riya couldn't stop thinking about it.

That day, she decided to become something new...

A Water Detective.

Your Mission Begins

Just like Riya, you are now part of a special mission.

Your goal: **Find where water is being wasted and think of ways to save it.**

For the next two days, observe at home and in school.

Look closely. Think deeply.

Ask yourself:

- Are taps left running when no one is using them?
- Is water spilling near drinking areas?
- Are leaking taps ignored?
- Does rainwater just flow away without being collected?
- Can used water be reused for plants?

Riya noticed something shocking – one tap in her school washroom was leaking all day!

"Just one drop," she thought at first.

But then she learned something important...

Even a small leak can waste **hundreds of litres** over time.

That's when she realised – small problems can become big ones.

And small actions can create big solutions.

The Science Behind the Story

Did you know?

Even though Earth looks like a "blue planet," most of its water is salty ocean water. Only a tiny portion is fresh and usable.

And that small amount is under pressure because of:

- Increasing population
- Pollution
- Climate change
- Overuse

Scientists warn that many cities may face serious water shortages in the future.

That means the future depends on people like you.

Yes – you.



Innovation Starts with Observation

Riya didn't stop at noticing the leak.

She asked questions:

"Why is this happening?"

"Can we fix it?"

"Can we prevent it?"

That's what innovators do.

They don't just see problems.

They **solve them**.

Innovation Spotlight

Riya discovered that students across India are already creating amazing solutions:

- Collecting rainwater from rooftops and storing it.
- Using drip irrigation to water plants without wasting water.
- Installing sensors that detect leaks.
- Creating awareness campaigns to change habits.

And guess what?

Most of these ideas started with simple observations – just like Riya's.

Activity: Become the Water Innovation Officer

Now it's your turn.

Imagine your school has chosen you as the **Water Innovation Officer**.

Your mission: **Reduce water wastage by 50%.**

Take a notebook and draw your school layout.

Mark:

- Where water is used (washrooms, drinking areas, gardens)
- Where water is wasted
- One smart solution to reduce wastage

Your idea can be:

- A new system (like rainwater harvesting)
- A behaviour change (like awareness posters)
- A simple fix (like repairing leaks quickly)

Remember: Innovation is not about expensive machines.

It is about **smart thinking**.

Think Like a Scientist

Riya shared her idea with her teacher. But before implementing it, her teacher asked:

- How much water will your idea save?
- Is it affordable?
- Can it be maintained easily?
- Will people actually follow it?

Riya realised something important.

Good ideas need testing.

Great ideas need improvement.



Reflection: One Drop Can Change Everything

At the end of the week, Riya helped fix the leaking tap in her school.

It seemed like a small action.

But it saved hundreds of litres of water.

And more importantly, it inspired others.

Remember:

Big changes don't always start in big laboratories.

Sometimes, they begin with a student who notices a problem...

...and decides to act.

Innovation Question

How can your school become a Zero Water Waste Campus?

That's how scientists work.

You can test your idea too – start small, observe results, and improve it.

Challenge for Young Innovators

Now comes your real mission.

Create a **Water Audit** for your classroom or home.

Find out:

- How many taps are there?
- Are there any leaks?
- How much water is used daily?
- Where can water be saved?

You can even talk to your classmates or family members.

Ask them about their habits.

Then prepare a simple report.

Share your findings.

Suggest solutions.

Be the change – maker.

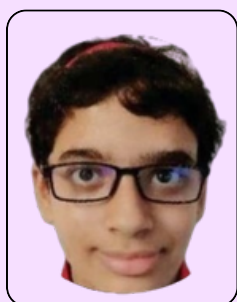
Riddles 2606

1. I travel billions of kilometres to touch Earth in 8 minutes – what am I?
2. I am everywhere but invisible, yet without me, you cannot live – what am I?
3. I can be solid, liquid, or gas, and still remain the same substance – what am I?
4. I am inside every cell, carrying the code of life – what am I?
5. I shine at night but borrow my light from another – what am I?

Voice Assistant for Deaf and Dumb

The “Powerless Speaker” is an eco-friendly device that amplifies mobile phone sound using a bamboo tunnel and tin containers without electricity. It is low-cost, sustainable, and made from waste materials.

Problem: In areas with limited or no electricity, people often cannot use electronic speakers for entertainment or group listening, especially in rural communities.



Shraavya Mishra
7th Class

Solution: The device uses bamboo, tin containers, and aluminium foil to amplify sound through multiple reflections. Made from recycled materials, it provides louder audio from mobile phones without requiring power, making it useful and affordable for rural areas.

(Source: INSPIRE MANAK NLEPC 2024 Booklet)

Grain Protector from Rain and Animals

Farmers work hard to cultivate crops and dry harvested grains to earn their livelihood. However, sudden rainfall during the drying process can damage the grains by increasing their moisture content, especially when no one is available to monitor them. To address this challenge, Maniprasad developed a cost-effective Grain Protector that automatically shields the grains from rain and also prevents damage caused by animals and birds, helping farmers protect their hard-earned harvest.



J. Maniprasad
9th Class

Problem: Farmers often dry harvested grains in open areas before selling them. Unexpected rain can leave the grains damp if they are not covered in time, reducing their quality, taste, texture, and market value. Animals and birds can also damage the grains during the drying process.

Solution: The Grain Protector uses a rain sensor based on the electrical conductivity of liquids, connected to a microcontroller and a motorized sliding cover. When rain is detected, the cover automatically closes to protect the grains. The system also includes a buzzer connected to surrounding wires that scares away animals and birds. This simple and affordable solution can be easily installed in paddy drying areas and rice mills to safeguard harvested grains.



(Source: INSPIRE MANAK NLEPC 2023 Booklet)

Indian Association for the Cultivation of Science (IACS), Kolkata

The Indian Association for the Cultivation of Science (IACS), founded in 1876 by Dr Mahendra Lal Sircar in Kolkata, is India's oldest research institute dedicated to fundamental sciences. A premier institution under the Department of Science & Technology (DST), it is renowned for nurturing C.V. Raman's Nobel Prize – winning discovery of the Raman Effect (1930).



Today, with campuses at Jadavpur and Baruipur, IACS continues to advance cutting – edge research and scientific education in physics, chemistry, biology, and mathematics. Its motto, "Unveil the Self," reflects its commitment to knowledge, discovery, and innovation.

Objectives

- Promote research in physics, chemistry, biology, materials science, and mathematics.
- Apply science to industry and society.
- Train future scientists through BS – MS, MS – PhD, and PhD programs.

Significance in Indian Research Space

- India's oldest scientific research institute.

- Birthplace of the Raman Effect, which earned India's first Nobel Prize in Science.
- A leading centre for fundamental and applied research.

Collaborations

- Supported by DST, CSIR, UGC, and international agencies like NSF and UNDP.
- Collaborates with universities and research institutes worldwide.

Achievements

- C.V. Raman's Nobel Prize (1930) for the Raman Effect.
- Hosts the Indian Journal of Physics (since 1926).
- Numerous patents in materials science and chemical innovations.
- Recognised globally for contributions to optics, magnetism, and nanoscience.

Future Vision

With the establishment of the **SMART Campus (2018)**, IACS is expanding **AI – driven research**, multidisciplinary science, and global collaborations to strengthen India's leadership in fundamental and applied sciences.



Indian Scientist

Narinder Singh Kapany

Padma Vibhushan (2021)



(1926–2020)

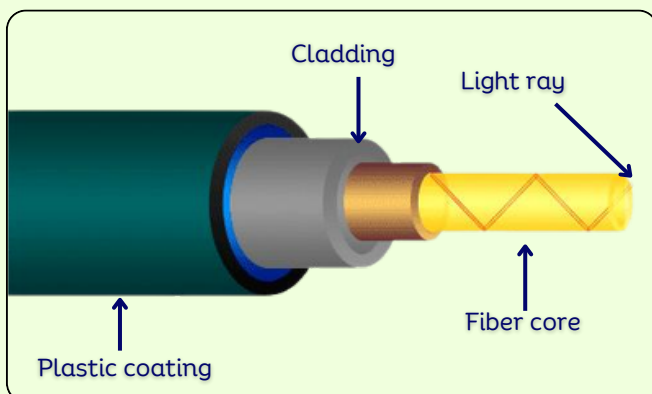
Narinder Singh Kapany was a pioneering Indian – American physicist, widely known as the **“Father of Fibre Optics.”** He revolutionised modern communication by developing technology that allows light to travel through thin glass fibres, forming the backbone of

- Internet
- Cable TV
- Medical imaging (endoscopy)

Without his work, modern digital communication would not exist in its current form.

Early Scientific Breakthrough

In 1953, he demonstrated that light can be transmitted through bundles of optical fibres with clarity. This experiment laid the foundation of fibre optics technology.



Major Scientific Contributions

- Pioneered fibre optics, proving light could travel through flexible glass fibres, laying the foundation for modern optical communication.
- Coined the term "Fibre Optics" (1960) and pioneered image transmission through optical fibre bundles.
- Advanced research in lasers, biomedical instrumentation, solar energy, and pollution monitoring.
- Held 120+ patents, published 100+ research papers, and authored the first book on fibre optics.

Roles, Jobs & Leadership

- Founded Optics Technology Inc., Kaptron Inc., and K2 Optronics, becoming one of the first Indian – origin technology entrepreneurs in Silicon Valley.
- Offered the position of Scientific Adviser to the Defence Ministry of India (by Jawaharlal Nehru)

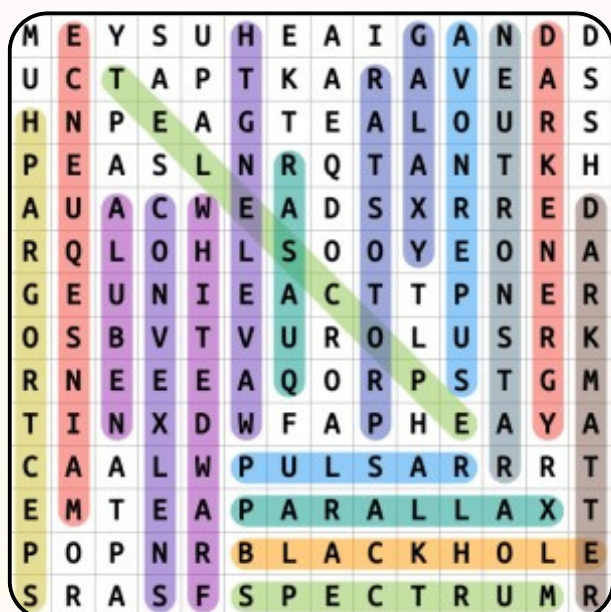
Awards & Honors

- Padma Vibhushan (2021, posthumous) – India's 2nd highest civilian award
- Named one of "7 Unsung Heroes of the 20th Century" by Fortune
- Featured among the top scientists of the 20th century (Time Magazine)

Legacy and Inspiration

Kapany's pioneering work in fibre optics revolutionised global communication and medical technology, forming the foundation of today's high – speed internet and optical communication systems.

Solution Word Search 2606



Solution Sudoku Challenge 2606

3	5	7	2	4	8	1	6	9
8	4	9	6	5	1	2	3	7
6	2	1	7	3	9	5	4	8
7	9	3	5	1	6	8	2	4
5	6	4	8	9	2	3	7	1
2	1	8	3	7	4	9	5	6
1	8	5	4	6	3	7	9	2
9	7	6	1	2	5	4	8	3
4	3	2	9	8	7	6	1	5

Riddle 2606 Answer

1. Sunlight
2. Oxygen
3. Water
4. DNA
5. Moon



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for Guide Teacher



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for Student

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for Guide Teacher



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