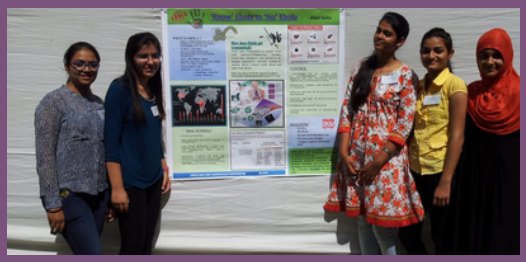

M.G. Science Institute
AHMEDABAD
MICROBIOLOGY SOCIETY OF
MS
MG
M.G. SCIENCE INSTITUTE
MICROBYTE
Discover The Invisibles
FEB 2026
VOLUME-4

About MSMG

(Microbiology society of M.G. Science Institute)



"Together we grow, together we shine – snapshots of MSMG through the years."













What is MSMG?

MSMG is a vibrant platform created by and for the students of Microbiology at M.G. Science Institute. It serves not only as a space to hone academic skills but also as a stage for developing leadership, creativity, and teamwork. While guided by faculty, MSMG is primarily student-driven and provides opportunities to learn beyond the classroom.

Organizational Structure

- Principal – Patron
- Head of Department – Chairperson
- Senior Faculty Member – Secretary
- Faculty Member – Treasurer
- Students' Council – The heart of MSMG, run by students themselves. Members of the council elect their own leader, and also form an editorial board for the society's biannual magazine.

A Journey through time

The roots of MSMG go back to 1996, when **Dr. Vivek N. Upasani** established the Microbiology Student Society (MSS) with the encouragement of Principal **Prof. N.I. Dani** and Head of Department **Ms Umaben Desai**. Though the society flourished initially, it eventually became dormant.

In 2011, a revival took place under the leadership of **Dr. Ayesha N. Rafique** (then Head of Department) who envisioned a broader role for the society. It was renamed MSMG to reflect this expanded scope. Since 2012, MSMG has remained consistently active, thanks to the support of principals including **Dr Jain, Dr Upasani, Dr Vora and Dr J.H. Parikh**, and the tireless encouragement of faculties. Most importantly, it has been kept alive by the enthusiastic participation of students year after year.

What we do?

MSMG has become a hub of learning, exposure, and expression. Its activities include:

- Inviting eminent academicians, alumni, and industrialists for guest lectures.
- Organizing study tours that blend science with exploration.
- Preparing students to shine at state- and national-level competitions.
- Hosting in-house contests that bring out creativity and innovation.
- Screening scientific documentaries and films to inspire curiosity.

Our students, under MSMG's banner, have brought pride to the department by **winning 15 trophies at GiBioN** and excelling in prestigious competitions like **Manthan, Biocalyx**, and more.

Voices in print – The Magazine

The society has also nurtured a strong publication culture. Over the years, it has brought out student-led magazines under different names—**MICROCOSM**, **BIO&ME**, **MICROBIOME**, and today, **MICROBYTE**. Each issue captures the creativity, scientific spirit, and collective voice of our students.

Looking Ahead

MSMG continues to grow with fresh ideas and bigger dreams. Some of its upcoming goals include:

- Expanding its reach to include M.Sc. students.
- Building a strong alumni network to connect past and present students.
- Hosting GiBioN at M.G. Science Institute.
- Marking a historic milestone—celebrating 60 years of the Department of Microbiology in a truly memorable way.

At its heart, MSMG is more than a society. It is a community of learners and leaders, carrying forward the legacy of Microbiology at M.G. Science Institute while constantly reinventing itself for the future.

From the Desk of MS. Parthvi Prajapati



As I begin my journey as a Teaching Assistant in the field of Microbiology, I am reminded that science is not only about understanding microorganisms, but also about nurturing curiosity and fostering a spirit of inquiry. Being part of this academic community has strengthened my commitment to learning, teaching, and growing alongside my students.

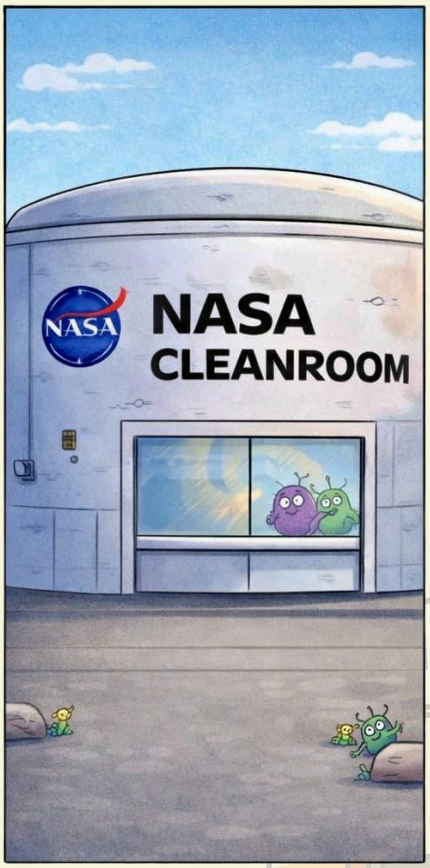
This magazine reflects our collective enthusiasm, creativity, and dedication to scientific exploration. I look forward to contributing to a learning environment where questions are encouraged, ideas are valued, and young minds are inspired to pursue excellence in science.

"Every microbe tells a story—of survival, adaptation, and the remarkable complexity of life."

~ Ms. Parthvi R. Prajapati
Faculty | Department of Microbiology
M.G. Science Institute

Are We Accidentally Sending Life to Mars?

"NASA discovers extremotolerant bacteria that survive spacecraft sterilization."



- These tiny organisms survived blasts of radiation, intense chemical scrubbing, and near-zero humidity
- Life in the Sterile Void: Extremotolerant Bacteria Identified in the NASA Mars Phoenix Cleanroom.

Introduction

The search for life beyond Earth begins, paradoxically, with eliminating life on Earth. To prevent terrestrial microbes from contaminating worlds like Mars, NASA assembles spacecraft in ultra-sterile cleanrooms designed to create a near-biological void through strict filtration and chemical sterilization.

Yet complete sterility remains elusive. Cleanrooms may act as evolutionary filters, eliminating fragile microbes while allowing extremotolerant survivors capable of withstanding radiation and desiccation to persist. If bacteria can survive the harshest sterilization protocols on Earth, could they also endure the journey to Mars? Recent genomic studies suggest this possibility deserves serious attention.

Genomic Investigation of the Cleanroom Microbiome

In 2007, during assembly of the Phoenix Mars mission at NASA's Kennedy Space Center, researchers collected 215 bacterial isolates from the spacecraft cleanroom—an environment designed to eliminate nearly all life. With advancements in genomic sequencing nearly seventeen years later, scientists re-examined these archived samples and identified 53 distinct strains, including 26 previously unknown species. Although these organisms represented less than 0.1% of the total microbial abundance, their persistence within such an ultra-sterile environment highlights the remarkable adaptability of certain bacteria to extreme chemical, radiation, and desiccation stress.

Extremotolerant Survivors of the Cleanroom

Agrococcus phoenicis

Main Substance :-
ε-poly-L-lysine
Applications:-
Food preservation;
Biomedical
anti-pathogen

Sphingomonas (2 novel sp)

Main Substance :-
Zeaxanthin
Characteristics :-
Potent antioxidant;
Eye health supplements

Paenibacilluscanaveralius

Main Substance :-
Bacillibactin
Characteristics :-
Iron acquisition
(Siderophore)

Genomic Insights into Space Adaptation

Although early tools could not fully identify these microbes, advances in DNA sequencing over the past 17 years enabled detailed genomic profiling. As noted by Alexandre Rosado, several species possess genes that may support adaptation to the stresses of spaceflight.

Environmental Parallels Between Cleanrooms and Mars

Cleanrooms

- Controlled
- Artificial sterility
- Low humidity
- Minimal nutrients
- Chemical sterilization

VS

Mars

- Extreme cold
- Extremely dry
- Poor-nutrient availability
- Naturally-hostile conditions

Conclusion

The discovery of novel bacteria in NASA cleanrooms challenges long-held assumptions about the limits of microbial survival. Their persistence under extreme sterilization conditions forces scientists to reconsider our understanding of resistance, adaptation, and environmental tolerance. These findings highlight the remarkable resilience of microbial life and underscore the need to continuously refine planetary protection strategies. As research advances, space-associated environments may emerge as a critical frontier in microbiology, offering new insights into how life survives under some of the harshest conditions imaginable.

IF MICROBES HAD SOCIAL MEDIA: UNDERSTANDING QUORUM SENSING CREATIVELY

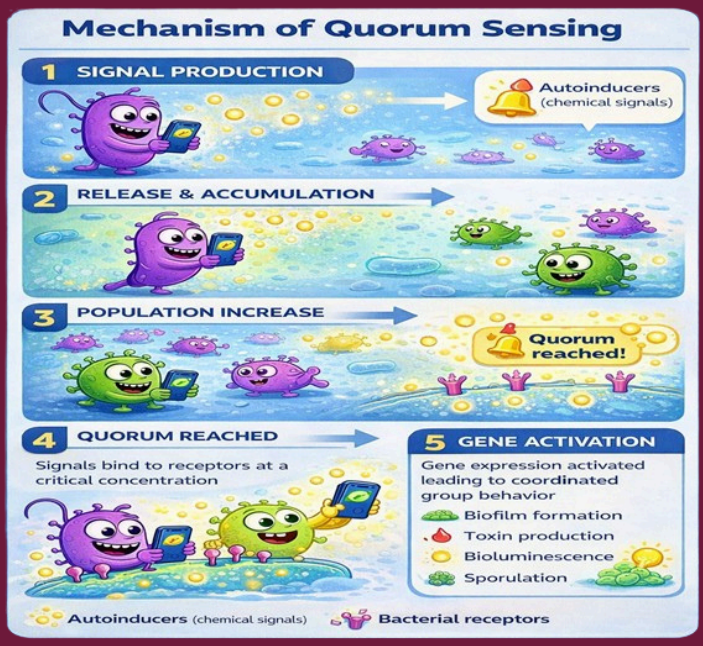
What if bacteria could tweet, post stories, or create group chats?

This isn't science fiction. Microorganisms constantly communicate through a fascinating process called quorum sensing—a microbial version of social networking that decides when and how bacteria act together.

A single bacterium has little impact on its environment. However, as the population grows, cells begin releasing small chemical signal molecules known as autoinducers. These molecules accumulate in the surrounding environment. When their concentration reaches a critical threshold, bacteria detect them through specific receptors and respond by activating particular genes simultaneously. This coordinated gene expression leads to synchronized group behavior, a process known as quorum sensing.

Different groups of bacteria use distinct signaling molecules. Gram-negative bacteria typically rely on acyl-homoserine lactones (AHLs), while Gram-positive bacteria use short peptide signals. Another molecule, AI-2, enables communication between different bacterial species, allowing interspecies coordination within mixed communities.





Once a quorum is reached, bacteria act collectively. For example, Pseudomonas aeruginosa produces virulence factors only when its population is sufficiently large to overcome host defenses. Similarly, Vibrio fischeri activates bioluminescence through quorum sensing, causing the cells to glow only at high densities.

Acting prematurely would waste energy and potentially alert the host immune system. Quorum sensing therefore ensures efficiency, stealth, and a stronger collective effect.

Researchers are investigating quorum quenching, a strategy that disrupts these signaling pathways. Rather than killing bacteria directly, this approach interferes with their communication, reducing coordinated harmful behavior. This method offers a promising alternative in the fight against antimicrobial resistance.

Although microscopic, bacteria depend on complex communication networks. For them, coordinated action is not social behavior—it is a vital mechanism for survival.

"From single cells to synchronized communities."

~ Aastha Pacheriwala (MSc SEM-2)

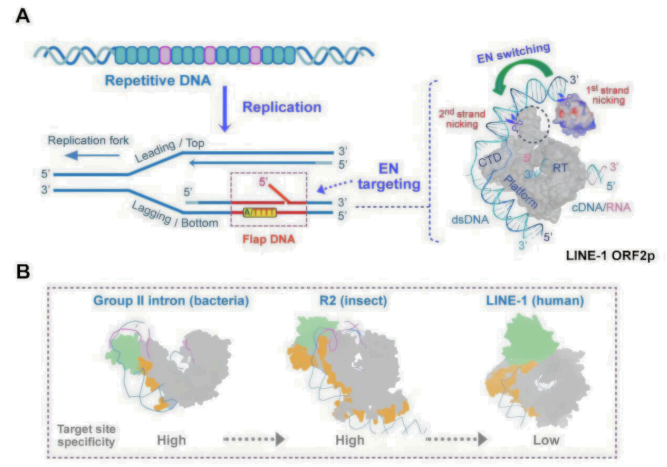
when DNA decides to move!

Jumping GENES:

Architects of Change

Why This Discovery Matters?

Beyond solving a long-standing biological puzzle, this research has far-reaching implications. Uncontrolled L1 activity has been linked to genomic instability, aging, and cancer. By revealing exactly how ORF2p binds and cleaves DNA, this study provides a new theoretical framework for designing therapies that could regulate or inhibit harmful retrotransposon activity.



LINE-1 (L1) is a remarkable "jumping gene" that makes up nearly 17% of the human genome. It is the only autonomously active retrotransposon in humans, capable of copying and inserting itself into new genomic locations. Despite its abundance and impact on genome evolution, the molecular mechanism behind L1 movement has long remained unclear.

In a breakthrough study published in Science (October 9), researchers from the Institute of Biophysics, Chinese Academy of Sciences have revealed how L1 retro transposition occurs at the molecular level. At the core of this process is ORF2p, a multifunctional protein that drives L1 mobility through target-primed reverse transcription (TPRT). ORF2p possesses both reverse transcriptase and endonuclease activities, allowing it to synthesize DNA from RNA and cut genomic DNA for integration.

Seeing the Invisible: Cryo-EM Reveals the Structure

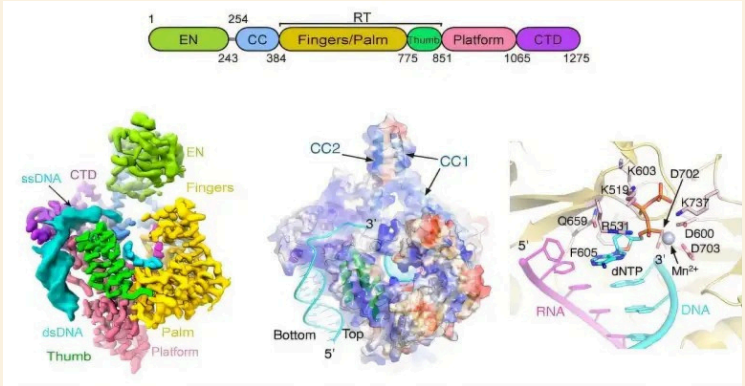
Led by Profs. Xu Ruiming, Zhu Bing, and Xue Yuanchao, the team purified an active ORF2p–nucleic acid complex and resolved its structure using single- particle cryo-EM

The structure revealed that ORF2p binds DNA mainly through electrostatic interactions with the DNA backbone, rather than sequence-specific recognition, enabling integration at diverse genomic sites. cDNA synthesis occurs at the reverse transcriptase active site, regulated by allosteric changes in key amino acids, fine-tuning L1 retro transposition. The researchers also established the first efficient in-vitro DNA cleavage system for ORF2p, showing that it functions as a structure-dependent endonuclease. ORF2p preferentially cleaves forked and flap DNA structures formed during lagging-strand replication, with conformational changes in the endonuclease domain enabling stepwise cleavage and linking L1 integration to the replication cycle. Comparative analyses with bacterial and insect homologs revealed that while reverse transcription is conserved, DNA recognition and cleavage mechanisms have diversified across species.

A New Chapter in Genome Biology

This work reshapes our understanding of genome evolution—revealing LINE-1 as a precisely regulated molecular machine, not a passive DNA element—working in coordination with the cell's replication machinery.

As research uncovers the hidden dynamics of our genome, such findings underscore a powerful message—even so-called "junk DNA" can hold profound biological significance.



-Aashvi Bhatt (TY SEM-6)

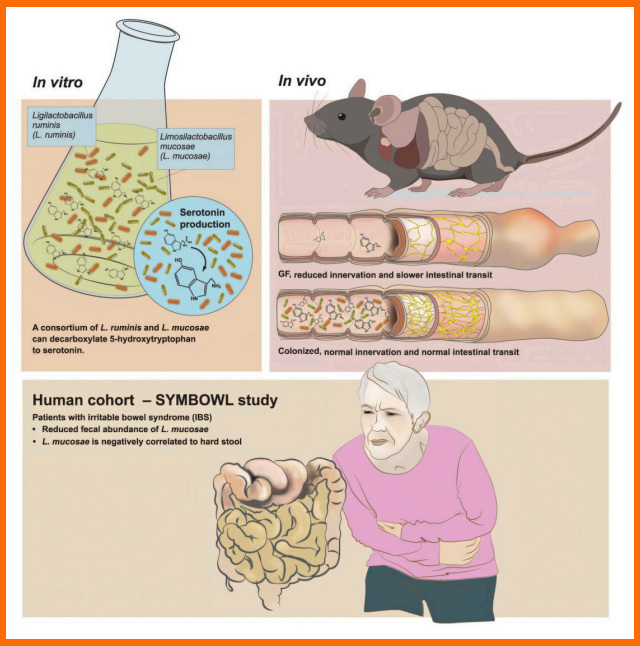
Gut Microbial Serotonin

A hope for IBS treatment

Research from the University of Gothenburg, Sweden, clarifies the complex interaction between gut bacteria and irritable bowel syndrome (IBS). Experiments demonstrate that gut bacteria can produce the important substance serotonin. This finding will help in future for treatments.

IBS, one of the most prevalent gastrointestinal disorders, affects millions of individuals globally. Abdominal pain, bloating, constipation, diarrhoea, or a mix of the two are its hallmarks. Although the exact origin of the illness is unknown, serotonin and the gut bacteria seem to have a significant role in the intestinal environment.

Serotonin, a well-known neurotransmitter in the brain but over 90% of the body's serotonin is produced in the gut, where it controls bowel movements via the enteric nervous system, sometimes called the "gut-brain".



Experimental Approach

In the current study, the researchers have identified two bacteria that together can produce serotonin namely, Limosilactobacillus mucosae and Ligilactobacillus ruminis.

When the bacteria were introduced into germ-free mice with serotonin deficiency, the levels of serotonin in the gut increased, as did the density of nerve cells in the colon. The bacteria also normalized the intestinal transit time. "It is incredibly fascinating how the gut bacteria can produce bioactive signalling molecules that affect health.", says Fredrik Bäckhed, Professor of molecular medicine at the University of Gothenburg.



Treatment Potential & Conclusion

Researchers found that individuals with IBS had reduced levels of L. mucosae, a serotonin-producing bacterium, compared with healthy individuals. These findings suggest that certain gut bacteria generate bioactive serotonin that influences intestinal health and gut–brain communication, offering new insights and potential treatment avenues for IBS.

On the whole, this study underscores the crucial role of serotonin-producing gut bacteria in regulating intestinal function and gut–brain communication. The identification of specific microbes capable of generating bioactive serotonin provides new insight into IBS pathophysiology and highlights the gut microbiota as an active regulator of intestinal and neural health. These findings open promising avenues for microbiota-based therapies targeting IBS and other functional gastrointestinal disorders.

~ Purva Patel (TY SEM-6)



THE SOUL OF THE STREET

Partnering with FSSAI to Elevate India's Culinary Heritage for the World

Street food in India is more than everyday convenience; it represent centuries of culinary evolution shaped by history, geography, and community traditions. From bustling markets to narrow lanes, these recipes embody regional identity and shared memory. As global tourism increasingly prioritizes authentic food experiences, India's street food holds immense potential as a distinctive cultural and economic asset.

1. The Role of the Food Safety and Standards Authority of India (FSSAI)

Sustainable transformation must begin with public health leadership. Under the Food Safety and Standards Act of 2006, FSSAI's mandate extends beyond regulation — it empowers vendors through scientific standards and institutional guidance, helping transition street food into a tourism-ready sector.

2. Clean Street Food Hubs and Infrastructure

Scaling Clean Street Food Hubs can convert informal vendor clusters into organized culinary zones. With potable water, waste management, and structured cooking spaces, these hubs demonstrate visible commitment to hygiene and quality.

3. Certification and Consumer Trust

Hygiene ratings and FSSAI certifications act as visible assurances of safety. By simplifying scientific standards into practical guidelines, vendors can confidently meet modern expectations.

4. Training and Capacity Building

Through Food Safety Training and Certification (FoSTaC) programs, vendors gain knowledge in allergen awareness, safe handling, and responsible preparation. Education shifts compliance into professional pride.

5. Digital Transparency and Monitoring

Digital verification systems and strong surveillance mechanisms increase accountability and consumer confidence. Transparency ensures safety becomes a shared responsibility.

6. Toward a "Healthy India" Culinary Identity

By promoting balanced preparation without compromising traditional flavors, FSSAI can strengthen India's global image as a safe and vibrant culinary destination.

~ Mutto Solomon Khaemba(TY SEM-6)

Hidden Resistance Horror: Your 'Healthy' Meal's Trap

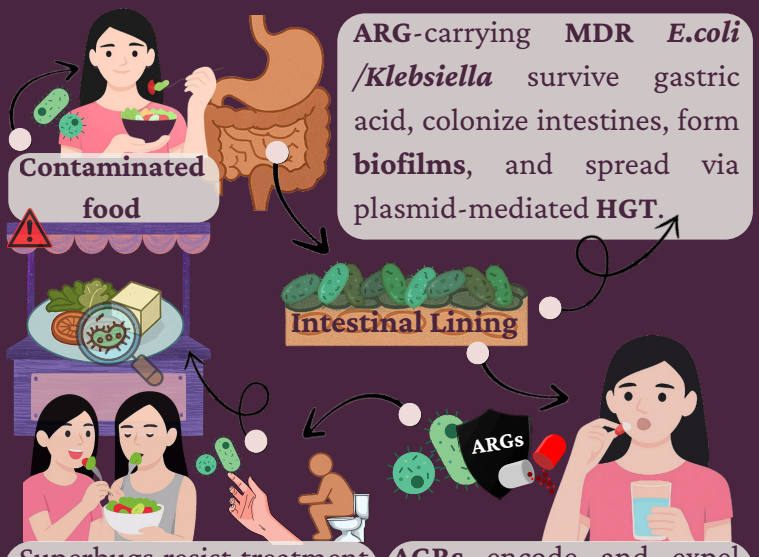
~How India's street veggies can crowd out superbugs and slash gut resistance genes — Like Thailand's festival magic

A **2025** study in **Infection, Genetics and Evolution (vol. 132)** analyzed sewage in Bangkok, Surat Thani, and Nakhon Sawan during the October 2019 Vegetarian Festival. Researchers found sharp increases in antimicrobial resistance (**AMR**) genes, carbohydrate-metabolism pathways, and bacterial diversity over the 10-day shift.

Crowded dining, shared plates, unwashed vegetables, and contaminated water fueled resistant ***E.coli*** and ***Klebsiella***—showing that even meat-free festivals can heighten public health risks.

Why it matters: Even short-term vegetarian shifts boosted antimicrobial resistance (**AMR**) in Thailand's sewage. Sampling before, during, and after the festival showed rising AMR genes and microbiome changes, confirmed by participant fecal samples. The study highlights that plant-based diets don't erase superbug risks and that sewage is a powerful public-health surveillance tool.

Antibiotic resistance genes (ARGs) transform ordinary bacteria into **superbugs** via a rapid chain initiated by contaminated street food.



Implications: AMR spans diets, wastewater, agriculture, and pharmaceuticals, demanding stronger sanitation and surveillance. In India, food safety hinges on hygiene, clean water, and responsible farming—**not labels**.

What to do?: Eat a balanced diet with adequate **fiber** (**31–38g/day** for **men**, **25–28g/day** for **women**). Limit street food, which often carries harmful microbes like coliforms. These microbes can spread resistance genes, fueling superbugs and **threatening the effectiveness of life-saving antibiotics**.

Fiber's role: Soluble fiber from lentils, oats, and berries feeds good gut bacteria, lowers gut pH, **suppresses resistant microbes**, and helps flush AMR genes—naturally abundant in **Indian cuisine**.

Daily defense: A meal of dal, bhindi or broccoli, plus guava or berries (**~21–23g fiber**) with curd or chaas delivers prebiotic–probiotic power—boosting digestion, immunity, and helping outcompete superbugs.

Remember why Indian mummas add curd to bhindi sabzi? It's the perfect prebiotic-probiotic duo! Beyond bhindi + curd, combos like dal + chaas or guava + yogurt deliver balanced, gut-healing meals daily.

Therefore, Never Say 'NO' to Mumma's cooking: It Beats Street Superbugs Every Time!. Mumma's home-cooked dal and sabzi isn't just comfort food—it's your superbug shield.

Your Superbug Shield: Meet daily fiber needs with probiotics, wash greens well, avoid street stalls, and insist on vendor hygiene certification to cut superbug risks.

Start your 9-day dal reset tomorrow—beat superbugs the **Indian** way. Maintain hygiene practice, Prioritize Sanitary Dining, Protect yourself and your loved ones from superbugs.

Share chaat-safe stories with **#IndiaVsSuperbugs**, **#DesiGutReset**.

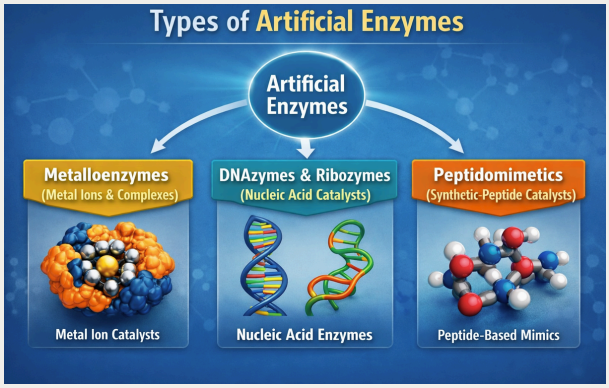
~ Sharvari Rathod (SY SEM-4)

ARTIFICIAL ENZYMES

"Man-Made Catalysts: Powering the Future of Science"

INTRODUCTION

Enzymes are natural catalysts that speed up biochemical reactions. Artificial enzymes are human-designed alternatives developed using AI and synthetic biology for medical, environmental, and industrial applications, and function under specific conditions.



DESIGN STRATEGIES

Various techniques are used to create the artificial enzymes. Some of them are –

1. **Rational Design** – using knowledge of enzyme mechanisms to design molecules that replicate active sites.
2. **Directed Evolution** – mimics natural evolution, involving mutation & selection with enhanced catalytic properties.
3. **De Novo Design** – new proteins can be designed from scratch to support catalytic activity and functional flexibility through computational design, catalytic nucleic acids, and nanozyme development.

APPLICATIONS

Artificial Enzymes have significant potential in various fields such as:

- Used in medicine for diagnosis and therapy
- Applied in oncology for targeted cancer treatment
- Utilized in biosensors for disease and chemical detection
- Help in smart drug delivery systems
- Used in biodegradation of pollutants and waste materials
- Assist in chiral synthesis for pharmaceutical production

FUTURE PROSPECTS AND CHALLENGES OF ARTIFICIAL ENZYMES

Artificial enzymes face challenges in efficiency, stability, and biological integration, but advances in computational design, machine learning, and synthetic biology are enabling applications such as CO_2 capture, medical nanomachines, and synthetic metabolic systems.

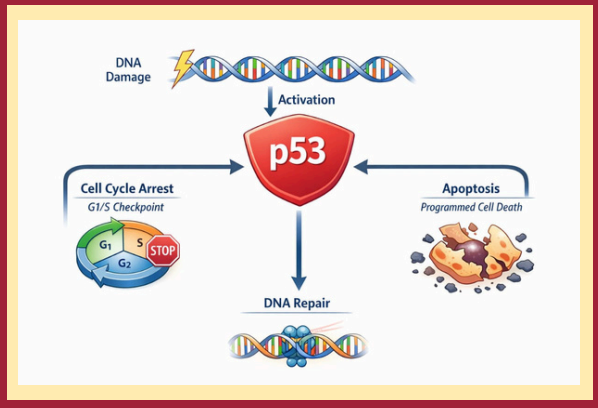
CONCLUSION

Artificial enzymes advance biological design by creating catalysts from scratch, enhancing biocatalysis and driving innovation in science and engineering.

-Ruchika Ramani (SY SEM-4)

Between DNA Damage and cancer stands one decisive protein- p53

P53: GUARDIAN OF THE GENOME



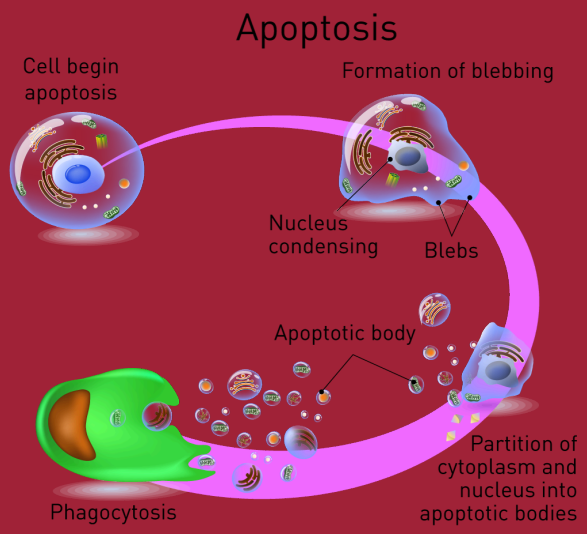
P53, also known as tumor protein p53 (TP53), is a regulatory transcription factor that is frequently mutated in human cancers. It plays a vital role in maintaining genomic stability and is therefore called the "Guardian of the Genome." As a tumor suppressor protein, p53 helps prevent cancer formation by protecting cells from genetic mutations.

Functions

The TP53 gene encodes a protein that binds to DNA and regulates genes involved in cell cycle arrest, DNA repair, and apoptosis. When DNA damage or cellular stress is detected, p53 stops cell division to prevent replication of damaged DNA and allows time for repair mechanisms to act. If the damage cannot be repaired, p53 initiates programmed cell death, eliminating potentially harmful cells.

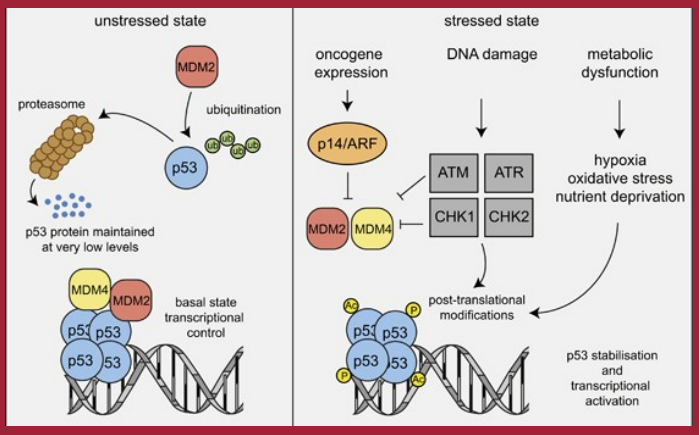
Apoptosis and Host Defense

p53 triggers programmed cell death & eliminates damaged or potentially cancerous cells.
p53 participates in host defense by limiting viral replication & inducing apoptosis in virus infected cells linking it to microbiology and immunology.



Discovery

p53 was discovered in 1979 by David Lane and Lionel Crawford during studies on the SV40 virus. It was initially misclassified as an oncogene due to its association with tumors, but later Arnold Levine and others clarified its true role as a tumor suppressor gene. Today, p53 is known as the "Guardian of the Genome.



Clinical Significance

Because of its central role, P53 has become a major focus in Cancer therapy research.
Scientists are exploring ways to restore p53 function in tumors where it is mutated. Gene therapy, small molecules that reactivate p53, and immunotherapies are all being investigated. Understanding p53 also helps doctors predict cancer progression and patient outcomes.

Conclusion

p53 is more than a protein—it safeguards genetic stability by repairing damaged DNA or eliminating irreparable cells, acting as one of the body's strongest natural defenses.

~ Riya Parikh, (SY SEM-4)

ONCOGENIC VIRUSES:
FRIENDS,FOES,OR SILENT KILLERS?

➤What are oncogenic viruses ?

* Oncogenic viruses are viruses that can initiate or promote cancer development by altering the genetic material or regulatory pathways of host cells.
* According to world Health Organization (WHO), nearly 15-20% of human cancers world wide are linked to viral infection.
* Virus can't replicate independently, they hijack host cellular machinery and sometimes this hijacking goes terribly wrong.

➤Types of Oncogenic Viruses

🧬 **DNA Viruses**

Carry DNA and trigger cancer by altering cell growth control.

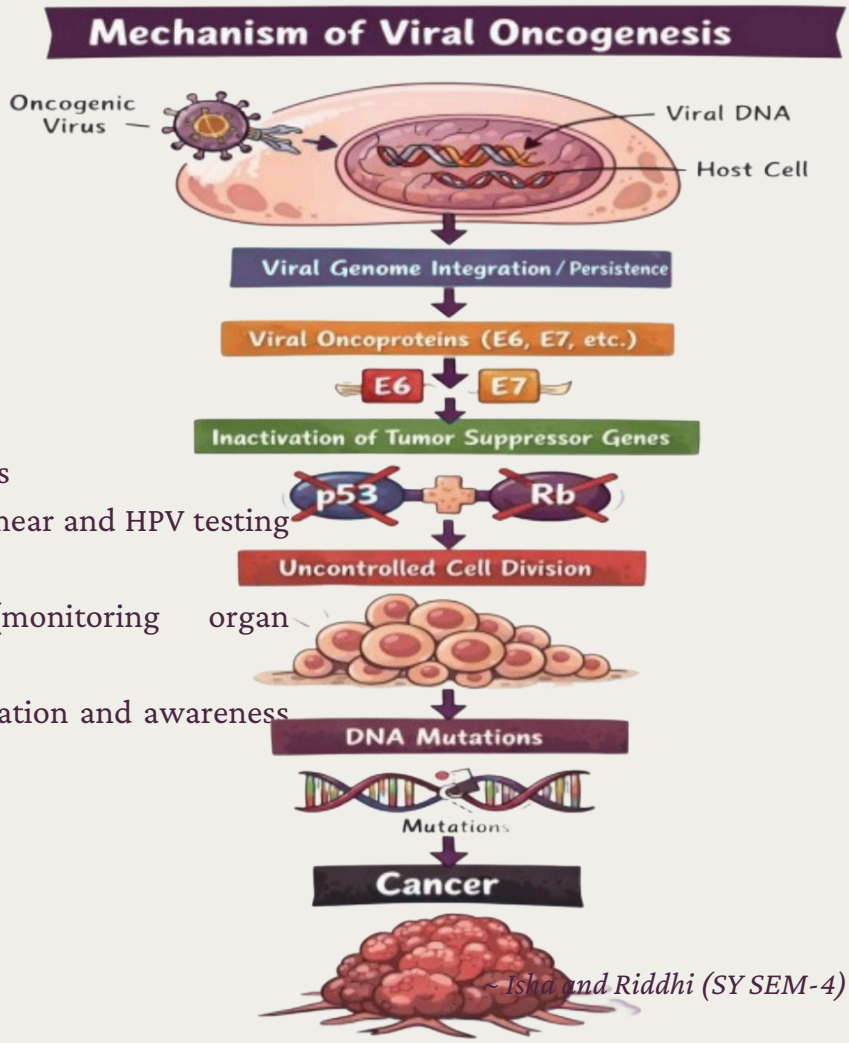
Examples: Human papillomavirus, Epstein–Barr virus.

🔁 **RNA Viruses**

Use RNA and promote cancer via reverse transcription or chronic cell damage. Examples: Hepatitis C virus

➤Transmission of oncogenic virus :-

- ❤️ Sexual transmission
- 🩸 Blood-borne
- 👶 Vertical (mother to child)
- 🤝 Close contact
- 🏥 Iatrogenic/healthcare
- 🫁 Long-term silent infection



➤Prevention :-

- Vaccination
- Safe lifestyle and behavioral measures
- Screening and early detection pap smear and HPV testing for cervical cancer
- Control of immunosuppresion(monitoring organ transplant recipients)
- Public health measures(Health education and awareness programs)

➤ Treatment :-

- Antiviral therapy
- Immunotherapy
- Cancer specific treatment

~ Isha and Riddhi (SY SEM-4)

Where discovery begins in absolute purity

NASA'S STERILE FRONTIER

NASA's Clean Room Shock



In May 2025, NASA's Jet Propulsion Laboratory (JPL) and KAUST announced a discovery that challenged long-held assumptions about sterility in space science. Inside spacecraft cleanrooms—designed to be nearly lifeless through HEPA filtration, UV radiation, and intensive chemical sterilization—scientists identified 26 entirely new bacterial species from 215 collected strains linked to missions such as the Phoenix Mars Lander.

"These microbes were not supposed to survive—yet they did"

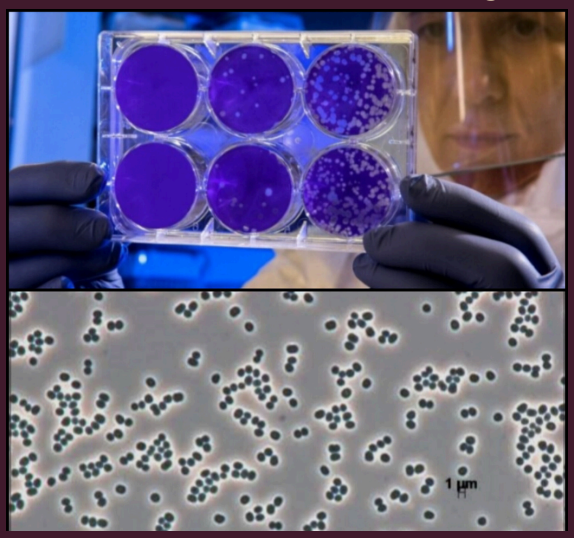
Many of the organisms are extremophiles with advanced DNA repair systems, resistance to disinfectants, and the ability to form protective biofilms. Some can enter dormancy to withstand extreme stress. One notable species, *Tersicoccus phoenicis*, survives by entering a "Viable But Non-Culturable" (VBNC) state and later revives using a resuscitation-promoting factor (Rpf) gene.

The 26 species, spanning 18 genera, include *Neobacillus driksii* (antimicrobial peptides), *Agrococcus phoenicis* and *Microbacterium canaveralium* (food preservation genes), *Sphingomonas* species (antioxidant potential), and *Georgenia phoenicis* (antimicrobial and anticancer properties).

A New Challenge for Planetary Protection

The discovery raises major concerns for planetary protection. If such resilient bacteria can survive extreme sterilization, they may endure interplanetary travel, posing a risk of "forward contamination"—the accidental transfer of Earth-based life to other planets. Dormant microbes could even be mistaken for indigenous Martian organisms, complicating the search for extraterrestrial life.

To address this risk, NASA scientists are developing planetary simulation chambers at KAUST. Beginning in early 2026, pilot experiments will expose these bacteria to Mars-like conditions, including low pressure, carbon dioxide-rich atmospheres, and extreme temperatures, to assess their survival potential and refine sterilization protocols



Beyond the risks, the discovery also offers promising applications. These microbes may contribute to biotechnology, medicine, food preservation, and bioengineering. Related strains such as Methylobacterium ajmalii, found on the International Space Station, have already shown potential in supporting plant growth for space farming.

Ultimately, this finding highlights both a challenge and an opportunity: as humanity reaches farther into space, understanding and controlling Earth's resilient microbes becomes just as important as exploring new worlds.

~ Devanshi Desai (FY SEM-2)

From Farm to Fork

The Role of FSSAI in Safeguarding India's Food through Science

~ Hygiene and science ensure every meal is safe!

Food is more than just a fuel; it's about trust on a plate. Every time we consume a meal, we believe that it is safe, hygienic, and fit for consumption. India, with its vast scale and diversity, render food safety management a demanding endeavour. So, this responsibility is carried out by the Food Safety and Standards Authority of India (FSSAI), an organization that quietly but decisively protects public health through science.

Farm-to-Table Journey

Food begins its journey at the farm and moves through processing, transport, and markets before reaching the consumer. At every stage, it is vulnerable to microbial, chemical,or physical contamination. Poor hygiene can allow pathogens like Salmonella, E. coli, and Listeria to contaminate food, causing foodborne illnesses and outbreaks. FSSAI plays a vital role in overseeing the entire food supply chain. By establishing science-based standards for production, storage, packaging, and distribution, it helps ensure that food remains safe from its source to the consumer.



Grounded in Science, Guided by Safety

Science is at the heart of FSSAI's work, using microbiological testing, risk assessmentc and laboratory analysis to detect hazard like pathogen, toxins,and contaminants.Evidence-based regulation permissible limit for additives and contaminants, aligned with international standards to ensure global-level food safety

"Food Safety is a journey, not a destination – one we all share!"

Preventing Food Contamination

Food contamination can result from poor sanitation, improper handling, and lack of awareness. To prevent this, FSSAI enforces Good Manufacturing Practices (GMP) and Hazard Analysis and Critical Control Point (HACCP) systems to identify and control contamination risks at critical stages. Consumer protection is further strengthened through inspections, surveillance, food recalls, safety audits, and hygiene ratings, enabling consumers to make informed choices.

Conclusion

From soil to plate, FSSAI ensures science-driven food safety. Through testing, risk assessment, inspections, and preventive systems, it protects public health and promotes safe practices. Food safety is not just regulation—it is a commitment to trust, health, and quality for all.

~ Gracie Chaudhari, Hardviba Rana(FY SEM-2)

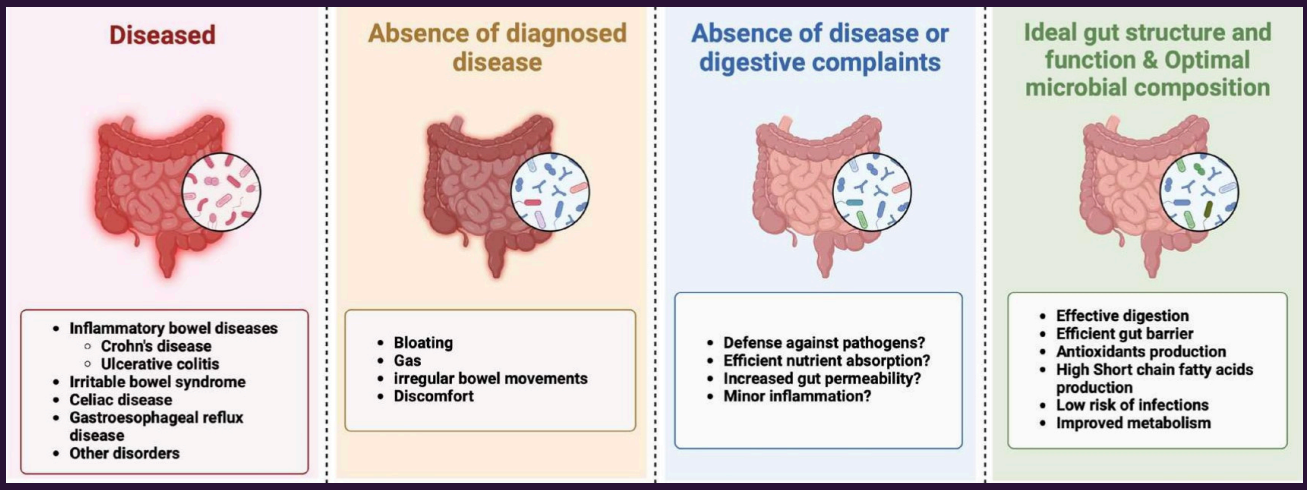
A Tiny Molecule, A Big Medical Surprise

How gut bacteria may lower the risk of Type 2 Diabetes

Recent research has demonstrated that the gut microbiome plays a significantly large role in metabolic health than previously understood. Scientists have identified a small molecule named trimethylamine (TMA), produced by gut bacteria when they decomposes choline, a nutrient commonly found in foods like eggs and meat.

Contrary to earlier beliefs, TMA does not adversely affect metabolic health. Instead, it protects against the harmful effects of high-fat diets by reducing chronic inflammation that contributes to insulin resistance and type 2 diabetes.

At the molecular level, TMA inhibits IRAK4, a protein involved in triggering inflammatory responses. By blocking this pathway, TMA improves insulin response, lowering the risk of developing type 2 diabetes.



Earlier studies linked a related compound, TMAO (trimethylamine N-oxide), to increased cardiovascular disease risk, making this discovery unexpected. Researchers now suggest that TMA and TMAO act differently, highlighting the complexity of gut bacteria and their metabolites. Although further human studies are needed, this finding opens possibilities for microbiome-based therapies—treatments that modulate the body's microbial community to improve health. Targeting gut bacteria or mimicking TMA's effect could offer strategies for type 2 diabetes, shifting our view of gut microbes from passive digestive helpers to active regulators of inflammation, metabolism, and long-term health.

~Khushi Patel (FY SEM-2)

THE GIANT THAT CHANGED MICROBIOLOGY

Beyond the Microscope



For decades, microbiology has been built on one basic assumption that bacteria are microscopic. However, the discovery of *Candidatus Thiomargarita magnifica* has challenged this long-standing belief, forcing a rethinking of traditional views on bacterial life.

Discovered in the mangrove swamps of Guadeloupe (French Caribbean), *Candidatus Thiomargarita magnifica* grows on decaying mangrove leaves underwater. It was first observed by Olivier Gros of Université des Antilles, and later studied by international research team , including scientists from the Lawrence Berkeley National Laboratory and the U.S Department of Energy Joint Genome Institute. It is a sulfur-oxidizing bacterium that can grow up to 1 centimeter in length, making it visible to the naked eye. This is extraordinary when compared to typical bacteria, which are usually only 1–5 micrometers long. In fact, this bacterium is nearly 5,000 times larger than most known bacterial cells.

What makes *T. magnifica* remarkable is not just its size,but it's internal organization too. Unlike conventional bacteria, it contains membrane-bound compartments("pepsins") storing its DNA—features resembling eukaryotic cells. This blurs the classical prokaryotic-eukaryotic divide, while its large genome and vacuole enable complex metabolism and overcome diffusion limits in fluctuating environments.

T. magnifica inhabits coastal mangrove ecosystems, specifically shallow marine and brackish waters. It is commonly found attached to decaying mangrove leaves and organic debris lying underwater.These environments are rich in sulfur compounds and low in oxygen, conditions that favor sulfur-oxidizing bacteria. Nutrient-rich, stable habitats support it's large size and slow growth, allowing the bacterium to thrive in the tropical mangroves swamps, such as those in the Caribbean region.

The article on the world's largest bacterium was published in the journal Science on June 24, 2022. This groundbreaking discovery challenged long-standing assumptions about the physical limitations of bacterial cells and overturned the traditional belief that bacteria must be microscopic in size. The finding revealed that bacteria are far more diverse, complex, and adaptable than previously believed, opening new avenues for research into microbial life and its evolutionary possibilities.

-Dhruvi Patel(FY SEM-2)

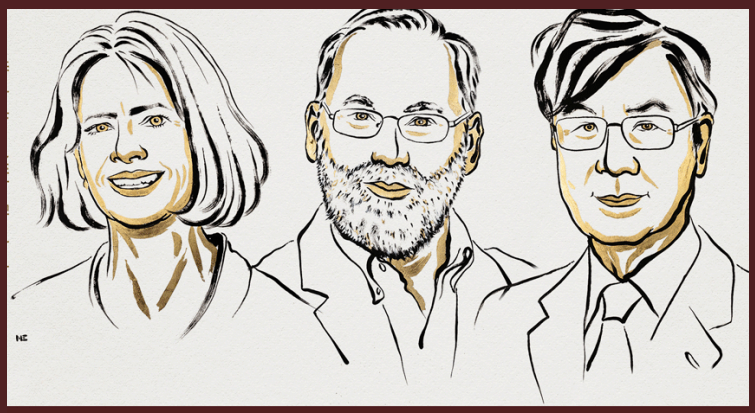
Nobel Laureates – 2025 (Physiology or Medicine)

The 2025 Nobel Prize in Physiology or Medicine was awarded to Shimon Sakaguchi, Mary E. Brunkow, and Fred Ramsdell for their important discoveries concerning ***Peripheral Immune Tolerance***. Their work revealed how the immune system prevents itself from attacking the body's own tissues, a process essential for maintaining health and preventing autoimmune diseases.

The immune system is designed to defend the body against harmful pathogens such as bacteria and viruses. However, immune cells must also be able to distinguish between foreign invaders and the body's own cells. If this recognition system fails, the immune system may attack normal tissues, leading to autoimmune diseases such as type 1 diabetes, rheumatoid arthritis, and multiple sclerosis. Peripheral immune tolerance refers to the mechanisms that control immune responses in tissues and organs outside the central immune organs, ensuring that immune cells remain tolerant to the body's own molecules.

One of the key discoveries honored by the prize was the identification of regulatory T cells (Tregs) by Shimon Sakaguchi. These specialized immune cells suppress harmful immune responses and act as "peacekeepers," preventing the immune system from attacking healthy tissues. Without Tregs, the immune system can become overactive and cause autoimmune disease.

Mary E. Brunkow and Fred Ramsdell discovered that the FOXP3 gene controls the development and function of regulatory T cells. They showed that mutations in FOXP3 cause severe autoimmune diseases, proving its essential role in maintaining immune tolerance and immune regulation



Mary E. Brunkow | Fred Ramsdell | Shimon Sakaguchi

Together, these discoveries showed that immune tolerance is an active process controlled by regulatory cells and genes, revealing how the immune system maintains balance and prevents self-damage.

The impact of these findings has been far-reaching in modern medicine. Understanding peripheral immune tolerance has opened new possibilities for treating autoimmune diseases by enhancing regulatory T cell function. It has also influenced organ transplantation by helping scientists develop methods to prevent rejection of transplanted organs. In addition, cancer researchers are studying how tumors exploit immune tolerance mechanisms to avoid immune attack, leading to new approaches in cancer immunotherapy.

These discoveries have greatly influenced modern medicine. Understanding peripheral immune tolerance has helped develop treatments for autoimmune diseases, improved organ transplant success, and advanced cancer immuno-therapy by revealing how tumors evade immune attack, leading to more targeted and effective therapies.



-Param Baxi (SY SEM-4)

KNOW YOUR CITY

INSTITUTE OF PLASMA RESEARCH

The Institute of Plasma Research (IPR), Ahmedabad- is a premier research centre run by the department of atomic energy under Government of India. IPL is best known for its work in plasma physics and fusion energy.Whereas PLASMA, often called the four state of matter consisting of ionised gases rich in reactive species such as ions, electrons and free radicals.

India is one of the leading partner countries in ITER(international thermonuclear experimental reactor) contributing a major high-tech and expertise through IPR(institute for plasma research). ITER is the world's largest nuclear fusion experiment run by 7 countries which works on fusion energy and aims to prove that nuclear fusion can produce more energy than it consumes.Major contributions of IPR is SST-1 and ADITYA.(India's first indigenously built tokomak fusion reactor).



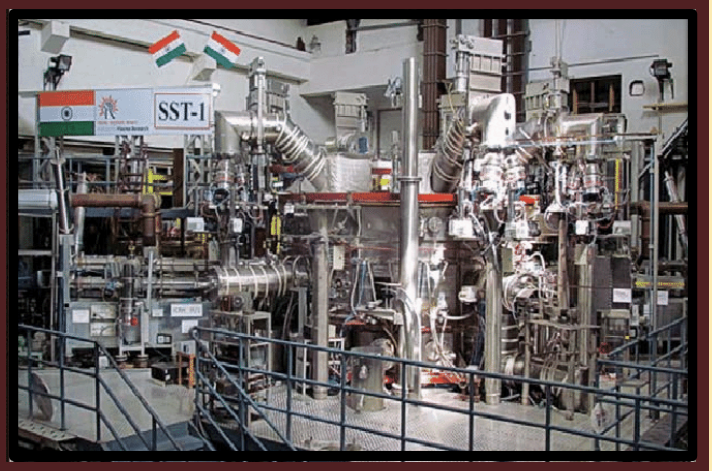


Biological interfaces in plasma application

Cold plasma is an important technology in microbiology that operates at near room temperature allowing safe contact with tissues and surfaces. It produces reactive particles that kill bacteria, fungi, and viruses making it useful for wound cleaning and medical sterilization.

•Plasma based methods are also being explored for biofilm removal, a major challenge in hospitals and industrial pipelines. Biofilms protect microbes from antibiotics, but plasma generated relative Oxygen and nitrogen species can distrupt these microbial communities effectively.

SST-1 (Steady State Superconducting Tokamak-1) is an advanced fusion research device developed by the Institute for Plasma Research (IPR). It confines extremely hot plasma using powerful superconducting magnets to study controlled thermonuclear fusion, mimicking how the Sun produces energy. Designed for long-duration plasma operation, SST-1 enables researchers to examine plasma stability, magnetic confinement efficiency, and heat transport under steady-state conditions. These studies are essential for overcoming key challenges in developing clean and sustainable fusion power. The project reflects India's growing contribution to global fusion research and future energy solutions.



~ Michelle, Anushka (FY SEM-2)

MICROTIMES

LATEST DISCOVERIES & DEVELOPMENTS IN MICROBIOLOGY, INFECTIOUS DISEASES, AND BIOTECHNOLOGY

"INVISIBLE THINGS ARE THE MOST POWERFUL. WE TRACK THEM FOR YOU."

Pan-Drug Resistant Bacteria Detected in ICUs

New strains of *Acinetobacter baumannii* and *Klebsiella pneumoniae* now resistant to all known antibiotics found in hospital ICUs.

🔍 Why it matters: Marks the arrival of a **"post-antibiotic era"** where common infections may become untreatable.

Nipah Virus Alert – India on Watch

Nipah virus outbreaks reported again in Kerala with human-to-human transmission. Fruit bats remain the main reservoir. No licensed vaccine available yet.

🔍 Why it matters: Fatality rate up to 75%; strict surveillance and isolation remain the only defense.

Microplastics Found in Human Blood & Lungs

Microplastics detected inside human tissues along with attached bacteria forming **"plastic-biofilms"**.

🔍 Why it matters: Raises concerns about chronic inflammation, infections, and long-term health effects.

Lurking Threats: The Overlooked Microbial Killers

Microbe	Origin	Risk
Variovorax durovernesis	Prosthetic graft infection	Emerging human Pathogen
Staphylococcus borealis	Human hospital samples	Multidrug-resistant misidentified pathogen
NDM-CRE (resistant *Enterobacterales*)	Global clinical infections	Emerging human Pathogen

Waterborne Superbugs

Studies reported the presence of multidrug-resistant bacteria in urban water sources and untreated groundwater.

🔍Why it matters: Unsafe water can spread hard-to-treat infections in communities.

🧪Advice: Use filtered or boiled water and support proper wastewater treatment.

The Forever Vaccine

Universal Cancer Vaccine in Trails

Scientists are testing a universal mRNA cancer vaccine in early human trials after successful animal studies.

🔍 Why it matters: A major step toward a universal cancer vaccine.

Biohazard Watch 2026

Alaskapox virus – Rare orthopoxvirus; increasing human infections in North America recently reported.

Langya henipavirus – Zoonotic virus from shrews; no licensed vaccine available.

Aspergillus fumigatus (azole-resistant) – Linked to rising untreatable fungal infections worldwide.

Candida auris (new clades) – *Rapidly spreading, highly drug-resistant fungus.*

THANK YOU FOR STAYING CURIOUS WITH MICROTIMES 2026!

FOLLOW US FOR MORE INVISIBLE INSIGHTS @msmg_mgscience

READ MORE »

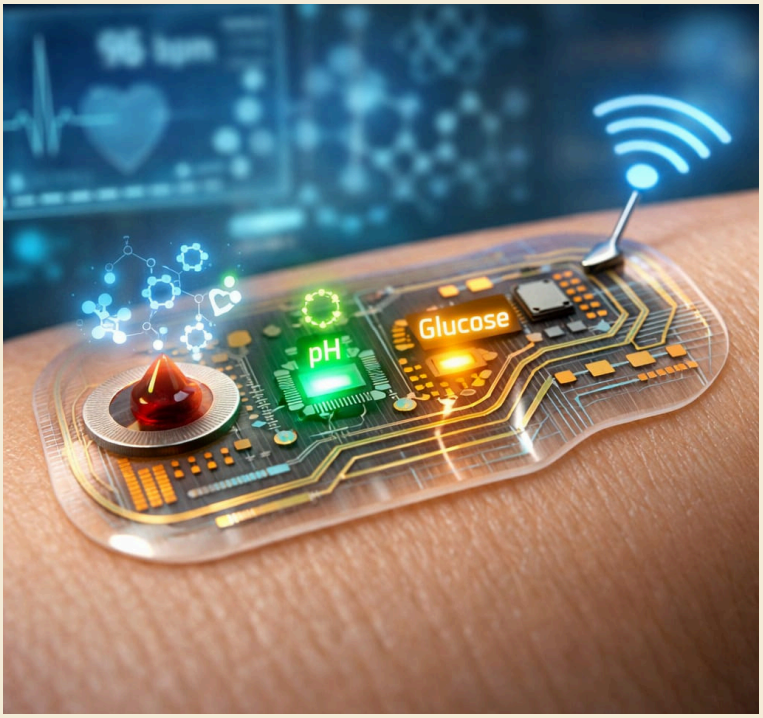
Guardians of the Unseen:
A BIOSENSOR'S PROMISE

In the quiet world of cells and spores,
Where microbes write their secret lore,
A silent guardian stands aware—
A biosensor, precise and rare.

Born from the heart of microbiology,
It blends with art and technology.
An enzyme waits, an antibody binds,
A living cell its purpose finds.

When glucose rises in the blood,
Or toxins stain the stream with mud,
It senses whispers, faint yet clear,
And turns them into signals we hear.

A molecule touches, soft and slight,
A reaction sparks, a flash of light.
An electric pulse, a measured flow,
Reveals what only microbes know.





From pathogen trails on culture plates
To viral clues that time awaits,
It guards our food, our health, our land,
With steady mind and steady hand.

In hospitals it saves a life,
Reducing doubt, reducing strife.
In soil and sea, in air we breathe,
It tracks the dangers we can't perceive.

Within its core, two worlds unite—
Biology's grace and circuits' might.
Protein folds and currents blend,
Where living science meets its friend.

O biosensor, small yet wise,
You help the hidden world arise.
Through you, the microscopic art
Becomes a language of the heart.

~ Deep Kanani (TY SEM-6)

ACTIVITIES

MAGAZINE LAUNCH- MICROBYTE (VOL 3) ON 29/08/25



Followed by interactive session by Dr. Nasreen Munshi on Bacterial Bioremediation





The department organized "Microbe Carnival" under the initiative of the Microbiology Society of M. G. Science Institute. The event aimed to promote scientific creativity and awareness through interactive activities, competitions, and student participation.



At the 36th GiBioN State-Level Inter-Collegiate Competition 2026 held at IIT Gandhinagar on 1st February, among 11 participants, Ms. Vishakha Rawat and Ms. Jiya Panchal won First Prizes, while Ms. Devangiba Zala secured Third Prize in the PG Bio-Reel event.

- A workshop on **Mushroom Cultivation** was conducted on 17 September 2025 by Mr. Hitesh Parmar, focusing on cultivation techniques, substrate preparation, environmental requirements, and entrepreneurial opportunities.
- **Aditi Dutt** (Sem-5) secured a Silver Medal in the Shri B. V. Patel Essay Competition 2025 on "The Role of Modern Technology in Combating the Menace of Counterfeit Drugs" (26 November 2025).

- **Vedant Sheladiya** participated in the National Level Essay Competition 2025 organized by LMCP.
- **Shruti Nandaniya** and **Miral Raiyani** (Sem-5) won the Gujarat University Youth Fest Inter-Zonal Level Skit Competition (10 September 2025).
- **Sadulla Aariz Simi** from Semester-5 secured First Rank in Minaxi Lalit Science Award Test 2025 in B.Sc Microbiology.
- CPL **Janki Pindoriya** participated in the Combined Annual Training Camp–124 at NCC Headquarters, Law Garden, and won a Silver Medal in the Dance Competition.
- **Tabassum M. Fabia** and **Mutto Solomon Khaemba** have been conferred with " Best Paper Award" for paper presentation titled "Anaerobic Digestion of Sewage Sludge as a Circular Economy Strategy: Environment and Economic implication of Biogas Procuction and Resource Recovery" at 11th International Symposium(INS) held during 30-31 January 2026 .

ACHIEVEMENTS



Celebrating Excellence: Top 50 in the University – BSc Sem 5











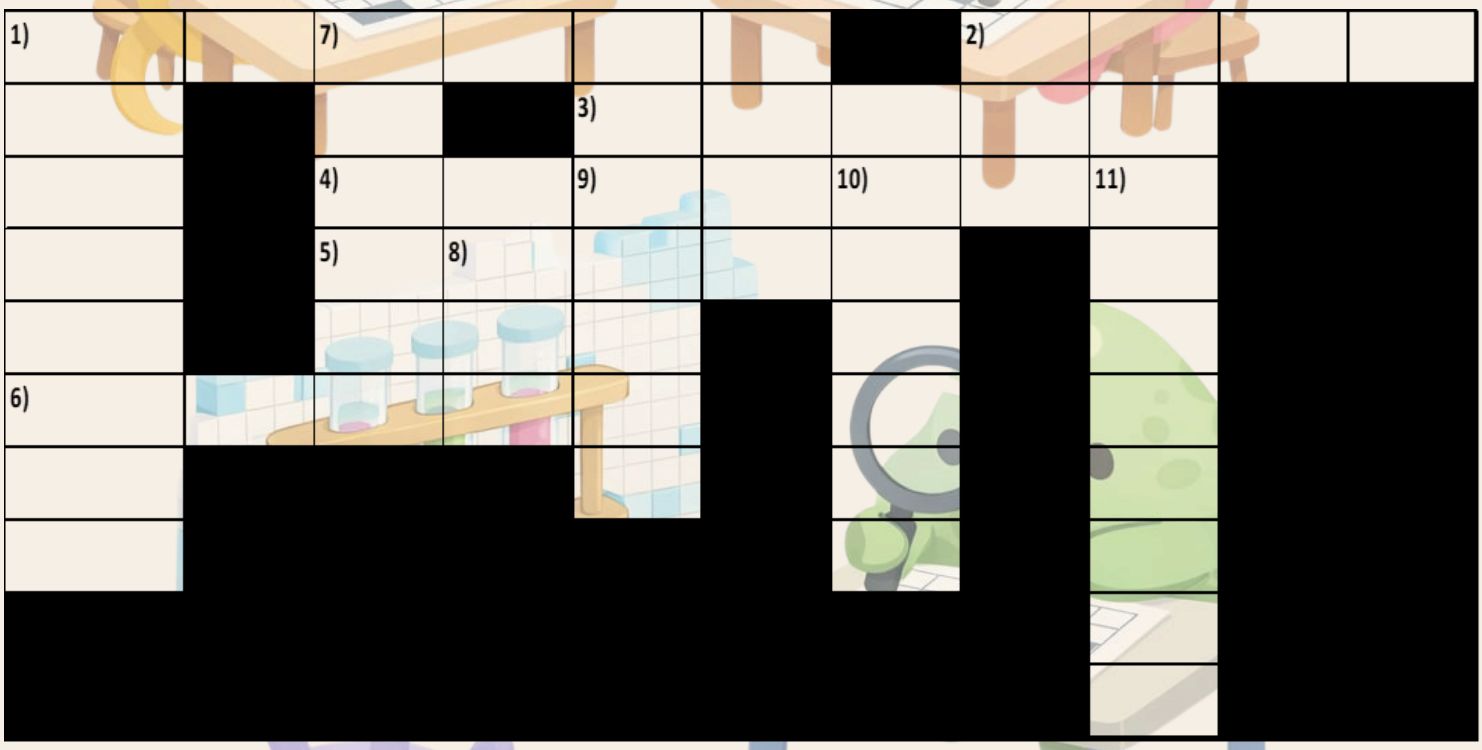




Pillar's of progress

- Dr. Noopur Goyal was appointed as Vice Principal (Additional Charge) of M. G. Science Institute by The Ahmedabad Education Society, effective from 01 July 2025.
- Under the guidance of Dr. Noopur Goyal, Ms. Kinjal Joshi successfully completed her Ph.D. on 19 Nov 2025.
- Dr. Payal Patel registered a copyright for the work titled "Sustainable Precision Fermentation Device" (31 - 07).
- Ms. Komal Chaudhari, under the guidance of Dr. Payal Patel and Dr. Noopur Goyal, presented a poster on marine *Actinomycetes* at an international conference jointly organized by the Department of Microbiology and Biotechnology, Gujarat University and IIT Gandhinagar, and secured Third Rank.
- Dr. Avni Divatia published a research paper titled "Enhancing Sustainability: Optimisation of Eco-Friendly Corn Starch Based Bioplastic" in the Journal of Environmental Bioremediation and Toxicology (2025).
- Dr. Noopur Goyal Published a research article titled " Chromium pollution Mitigation: Microbial approaches, genetic determinants and technological innovations" in Bioresource Technology Reports, Volume 33, February 2026.

SCRATCH



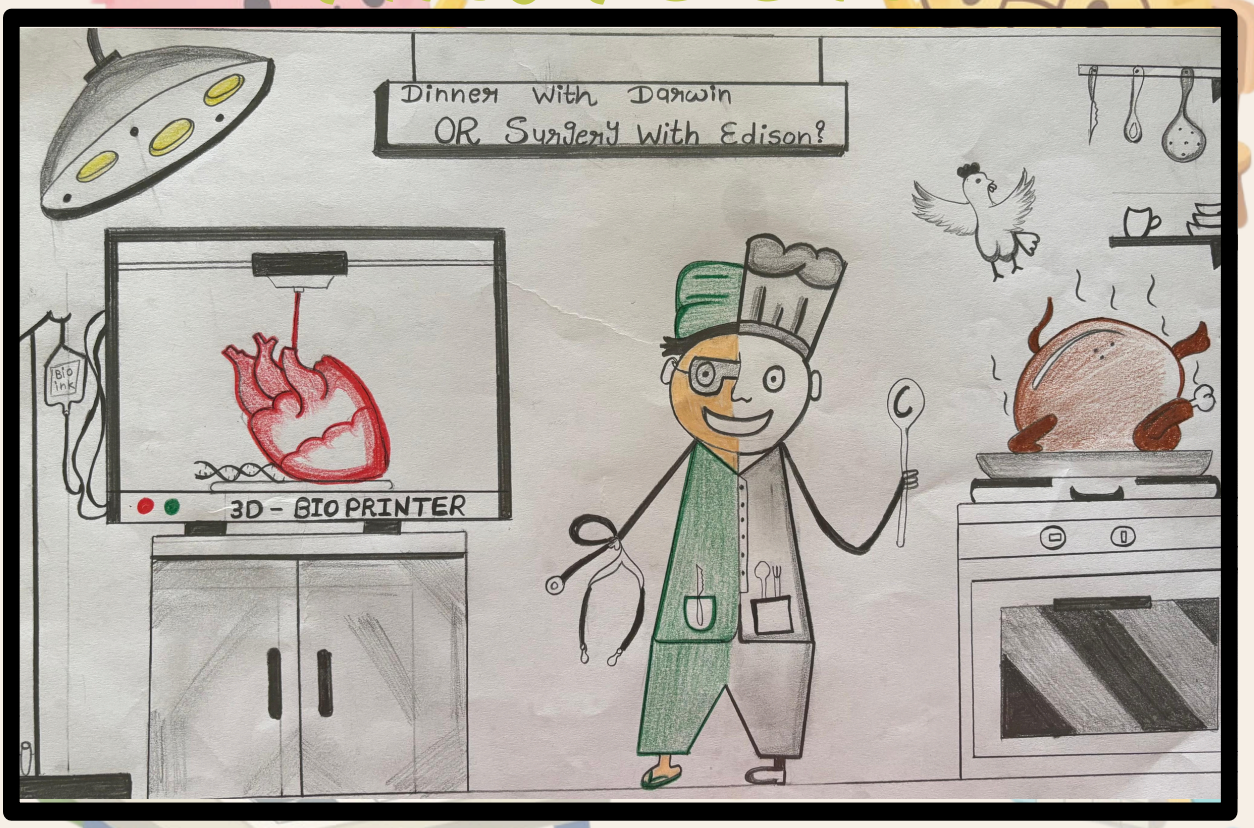
ACROSS

1. Viral Protein coat_____
2. Solid Culture Medium_____
3. Which eukaryote is a model organism in genetics?
4. Substance recognize by immune system?
5. Fungal reproductive structure_____
6. Which antibody is primary immunoglobin found in bodily secretions like saliva, tears & breast milk?

DOWN

1.Immune signaling protein_____
7.Antibody producing immune cell
8.DNA amplification technique
9.Microbial virulence factor
10.Total nucleotide sequence of an organism is termed ?
11.What group of parasitic roundworms infect Humans?

IT TINYTOON



MICROZZLES

1.“You won't find me on your palm or shelf, Yet I'm coded with instructions to copy myself. No nucleus to hold me down Still, in strange colonies, I wear a crown, who am I.”

2.“I cloak myself in sticky slime, Within your lungs I bide my time. Biofilms guard me from assault Antibiotics halt, what pathogen I am?”

3. “I walk the line between cure and curse, A moldy start, a Nobel verse. From fungal friends I took my birth, Saving lives across the Earth, who am I.”

5.I help bacteria stick to surfaces. I am shorter than flagella. I play a key role in attachment and conjugation. What am I?

https://drive.google.com/file/d/1DXc0MiP49yP9BbypaZWPaye-V3p1kT2d/view?usp=drivesdk

behind the BYLINE



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