

Cogito 137

The Thought Capsule

Feb 22'

Issue 11

A Generation of Lost
Researchers

Miniscule Beach | P. Fathi-Hafshejani & S. A. Taba

The main idea was to connect the real world with the nanomaterial world observed in a scanning electron microscope (SEM) and how we can engineer nanostructures. The image width is 0.254 mm.

Credit: Parvin Fathi-Hafshejani and Seyed Adib Taba, Auburn University/NanoArtography

2nd Year Anniversary Issue

Turning two: 2nd Anniversary Edition, Cogito137

Cogito-137 is an entirely student-run science communication platform that tells stories of and around science. Team Cogito137 consists of IISER Kolkata students and alumni in about 15-20 functional positions. Primarily a bi-monthly magazine, we dabble in all things science and in all forms. We create and publish content on our website in the form of articles, artwork, reviews, interviews, along with videos on our YouTube channel.

In this second anniversary issue of the magazine, we have a long lineup of articles spanning varied interest areas. The majority of the pieces have been contributions from participants of the “Scicomm for Scientists (SFS) 2021” Workshop conducted by Cogito137, supported by the Department of Science and Technology (DST), Government of India. Delve into this edition to read an array of fresh topics and thought-provoking perspective pieces. The guest editorial of this edition - “A generation of lost researchers”, by Raunak Dey, an IISER Kolkata alumni, discusses problems and predicaments of early career researchers through the pandemic.

Other articles in this issue include- the use of orchids in cancer treatment, the environmental impact of COVID-19, probiotics, smartwatches for diagnostics and more. How do our dog friends perceive us humans and our bonding with them? What drives the peaceful coexistence of humans and wildlife in a changing landscape? Curious to know how coffee affects fat distribution? Or about a device meant for tracking fat burning? Take a journey through our anniversary issue- flip through in one go or several. We have got you covered from dark matter to neurons!

You can find each article in the magazine on our website. Please send us your feedback and mention us on social media channels- Twitter, Linked-IN, Instagram and Facebook.

Like all previous ones, this special issue has been the fruit of ongoing relentless efforts from the entire team- our editors, designers, website and publicity team. We thank all contributors for this edition and hope we continue to get future submissions strewn across the spectrum of sciences. This has been a unique learning experience for all team members, gaining experience in scicomm.

This is also a special opportunity to thank our faculty advisor - Prof Subhajit Bandyopadhyay, Prof. Sourav Pal - Director, IISER Kolkata and Dr Anindita Bhadra - Associate Dean of International Relations and Outreach, IISER Kolkata, who have been our pillars of support since the inception of Cogito137, both morally and with their strategic and outreach expertise. We are grateful to the SFS-2021 speakers for sharing their knowledge, and feedback given by Spoorthy Raman for the SFS articles.

We hope you enjoy the magazine.

Sanskriti Biswal
Managing Editor, Cogito137.

EDITOR'S NOTE

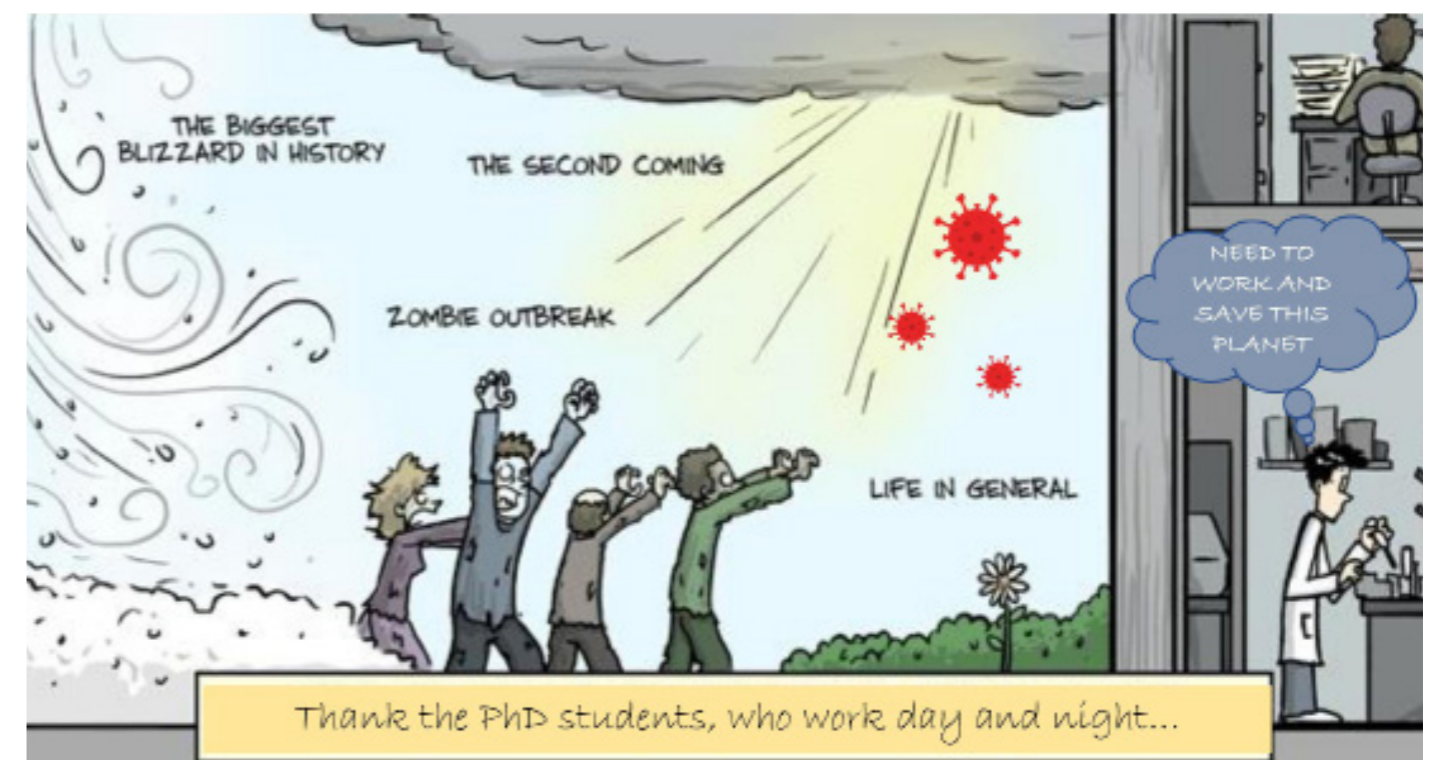
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Raunak Dey

A generation of lost researchers

A young research scholar's point of view on the plight of the careers and mental health of his peers and colleagues, as the pandemic ravaged the globe.



No danger — PhD students at work
 Source: The PhD comics, edited by Raunak Dey.

COVID-19 has changed the way we interact in this and with this world. It has affected jobs, disrupted the global economy in the process, killed millions, and negatively impacted billions of lives. While the utter devastation brought down on us by this harrowing pandemic has been widely cultured by the media for more than a year, the problems faced by early-career researchers in a developing country like India hasn't received enough attention.

The young scientists in India have received a massive setback in their ongoing research, career, and mental health. "COVID-19 has created a generation of lost researchers", lashes Dipti, who has been waiting for countries to lift their travel ban on Indian commuters so that she can join her post-doctoral research position in Canada. Rupesh is attending a Ph.D. program at Cambridge; he has booked his accommodation and paid a hefty security deposit to lease the apartment. Then came the travel ban. "How would I manage to sublease it now!" says a dejected Rupesh, simultaneously waiting to get a refund on the canceled flight. On the other hand, Viki is waiting for a year to join his Physics Ph.D. program due to the travel ban and unavailability of visa slots. The consulates all closed their operations after the second wave of Covid-19 stormed India. A career in science has an extensive gestation period, so this gap year has taken a significant toll on his overall mental health. He has already invested too much time, energy, and most importantly money in the process and can't

just step back now. These are not solitary examples, but how the situation of outgoing students of this country looked, even a few months back, searching for advanced and well-funded research opportunities.

It has been worse for Ph.D. students in India due to myriad problems. "I need to perform experiments for the review provided by the referee, but the labs are closed," says Avijit in a tense voice. The review process is also taking longer than usual time, delaying the publication of his papers. Indeed, these people who toil hard every day, suddenly found themselves amidst a pandemic, trapped inside a sealed campus with closed laboratories. The security staff who monitor the gates, the people who run the canteen, and the janitors – cannot come to the campus. So the onus fell on the students to take care of almost everything in a campus more than 100 acres in size. They did not complain, but even took time out of their engaging schedule and volunteered to help the indigent local community around the campus with food, supplies, and medicines. However, even after all this, if their principal pursuit in life becomes compromised – a gnawing feeling of helplessness, ultimately leading to acute pathological depression may not be far away. Ph.D. funding generally expires after a stipulated time, and these researchers have already lost a year. So Abdul, a Ph.D. student, being the only earning member of the family, decided to quit his Ph.D. and look for a job. Even people who had funding



Credits: Charlotte May, Pexels

remaining didn't receive their stipends or contingencies on time. It particularly became hard for Ramesh, who started his family during his Ph.D. and has a kid at home. He claims to have not received his CSIR/UGC fellowship for many months now. With the lack of direct benefit transfer, that's been the routine for fund distribution for Ph.D. students in India. Priti works in a behavioral biology lab, studying the population of zebrafish for ecological purposes. She said, "even if the lab is sealed, I need to come here every day on special permission to feed the fish." She needs to be there at the institute, while worrying about her COVID positive father residing in a different state. Preeti's father got lucky, but Avik's mother did not share the same fate. Avik flew back to India from Germany, taking a sudden leave from his postdoctoral position in a desperate attempt to save his mother. Tragically, all his efforts were lost in vain.

The campuses became melancholic. The senior students are trying to restrict themselves to maintenance work only, following strict regulations imposed by the authorities. The younger students are still at home trying to attend classes and submit their assignments on time, struggling with volatile internet connections. Rishi, a MS student, who could hardly finish a thesis; now wonders about his new Ph.D. applications. Some professors in Europe would rather recruit a second preference student for an open position than wait for the best-in-class Indian researcher with a delayed joining date. He sits at home and questions all the decisions he ever took. He is a bright student but slowly sinks into depression and self-doubt -- he is seeking professional help.

In spite of all psychological and situational impediments, these brave-hearts go on, analyze the protein of SARS-COV₂, or calculate if airflow indeed affects the dissemination of the virus. Research can't wait. They run the gels, plot the data, analyze the results, or try to come up with a DIY version of affordable ventilators. How can they do that? Maybe because they are by instinct problem solvers, trained to judge everything objectively. Their education and life in science has trained them to do so. They may be "a little lost" for now, but hopefully, they will find their way out of this mass dystopia.

India needs them to.

Otherwise, the price of the pandemic will be virtually never-ending, with the future incurring larger damages than what the present can even imagine.

[Some names have been changed to maintain anonymity]



Credits: Pexels



Credits:
Artem Podrez,
Pexels

Author bio:

Raunak Dey graduated from IISER Kolkata in 2020 with a BS-MS in Physics and is currently pursuing a Ph.D. in Physics at Georgia Tech, USA.

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Towards a Sustainable Earth

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AT THE INTERFACE OF
PHYSICS AND BIOLOGY
Dr. Rumi De
Dr. Rumi De is an associate professor at the Department of
Physical Sciences, IISER Kolkata. In this electronic interview she
narrates her journey of child like curiosity leading to a career in
interdisciplinary scientific research and how extra curricular
activities help in the holistic development of young minds.

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Illustration of Design by Anindita Bhadr

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TECHNOLOGICAL ADVANCEMENTS
Dr. Megha Vagadia
Dr. Megha Vagadia is an experimental condensed matter
physicist and material scientist at IISER Bhopal. In this electronic
interview, she talks about her exciting field of research, her views
on balancing gender ratios in academia and interesting alternate
career options outside academia.

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Of Flawed Humans and
Cultured Dog

People have been sharing spaces with large mammals like elephants and leopards for eternity in northern West Bengal. But over the last few decades, this region has been reporting one of the highest human-wildlife negative interactions globally. A group of scientists are trying to find how the coexistence of human and wildlife can be promoted in this pristine yet modified landscape.



Credits: Aritra Kshetry

Anish Paul

**Love thy
neighbor: Can
humans and
animals live
next to each
other in peace**



A leopard wandering in a tea estate
Credits: Aritra Kshetry

Elephants and leopards can live and roam around in human-use lands without promoting negative interaction. Even though this might sound fictional, a study published in the journal “Global Ecology and Conservation” in January, 2020 argues that this might be the key to secure the future of these animals in northern West Bengal.

The paper, authored by Aritra Kshetry and collaborators, urges us to look beyond the protected areas and curate a pathway for promoting safer shared spaces among human and wildlife. “Persistence of large threatened mammals is rarely investigated outside protected areas”, said Kshetry, a DST-INSPIRE fellow studying leopards and elephants in the tea estate dominated forest-agricultural landscape mosaic in West Bengal for his doctoral studies. “All the conservation focus is restricted to forested areas only”, he opined.

In India, there are hardly a few patches of “pristine wilderness” left for wild animals and only 5% of the total land is designated as protected areas. Hence, it is impossible to conserve India’s extravagant wildlife inside the wild only. “Wild

life does not understand our man-made protected area borders”, remarked Vidya Athreya, a Scientist at Wildlife Conservation Society-India and a co-author of the study.

The study area, tea-plantation dominated human-use landscape of West Bengal, records one of the highest instances of human casualties by leopards and elephants worldwide. This naturally stirs a sense of fear and stigma related to these animals among the locals. Human deaths and economic loss often leads to retaliatory killing and hampers conservation activities. The study deals with both ecological and social parameters of human-wildlife interactions to understand how ‘conservation beyond boundaries’ can be promoted in this land of conflict. They surveyed around 1200 km² of non-forested areas consisting of tea-estates, agricultural land, and human settlements to understand how leopards and elephants make use of it. Leopards have been found to be a ubiquitous resident of the dense tea plantations, and they use them as breeding grounds as well. No leopard presence has been observed in agricultural lands. Elephants, in contrast, use plantations, agricultural lands and human habitations as corridors to



The native vegetation of Dooars is represented by a matrix of Sal-dominated moist tropical lowland forests along with patches of riverine grasslands
Provided by Author

move from one forest patch to another.

Their study also conveys how local stakeholders of different socio-economic levels can contribute to tackle human-wildlife negative interactions. The authors reviewed the existing literature from the land. They merged it with their five-year long experience in the area. Together, it revealed the potential role of each existing stakeholder to curtail the negative impacts of human-wildlife coexistence. Results show that district and tea-estate administrations have the most influential role in minimizing the negative interactions. Actions like installation of solar fencing, lights, early alarm systems etc., production of loud sound before the commencement of work and prohibition of illegal alcohol brewing, if taken by these two authorities, can positively impact human-wildlife encounters.

The paper aims to promote the idea of identifying conservation-compatible landscapes outside protected areas by addressing the persistent

scenarios of conflict and coexistence present in the study area. “Development of conservation strategies to ensure long term persistence of these species in such habitats and mitigation of current and future conservation conflicts,” replied Kshetry when asked about future steps. The study, according to Kshetry, “may be applicable to other tea-plantation dominated landscapes where leopards and elephants are present, especially fragmented forest-tea mosaics of Assam, Sri Lanka and Nilgiris.” Dr. Athreya opined that this study can promote coexistence everywhere in the country where human and wildlife share space.

This study aims to serve both the ecological needs of wildlife and the socio-economic needs of locals. It can be considered as a framework to foster long term human-wildlife coexistence in areas with high human density.

Reference

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Tea workers plucking tea leaves in a tea estate of Dooars
Provided by Author

Author Bio:

Anish Paul is a student of MSc Ecology at the Pondicherry University. He is interested in singing, writing and travelling and wants to study the ecology, behaviour and conservation of mammals to make a living

Arshpreet Kaur

Natural cure for Cancer: Are Orchids the panacea?

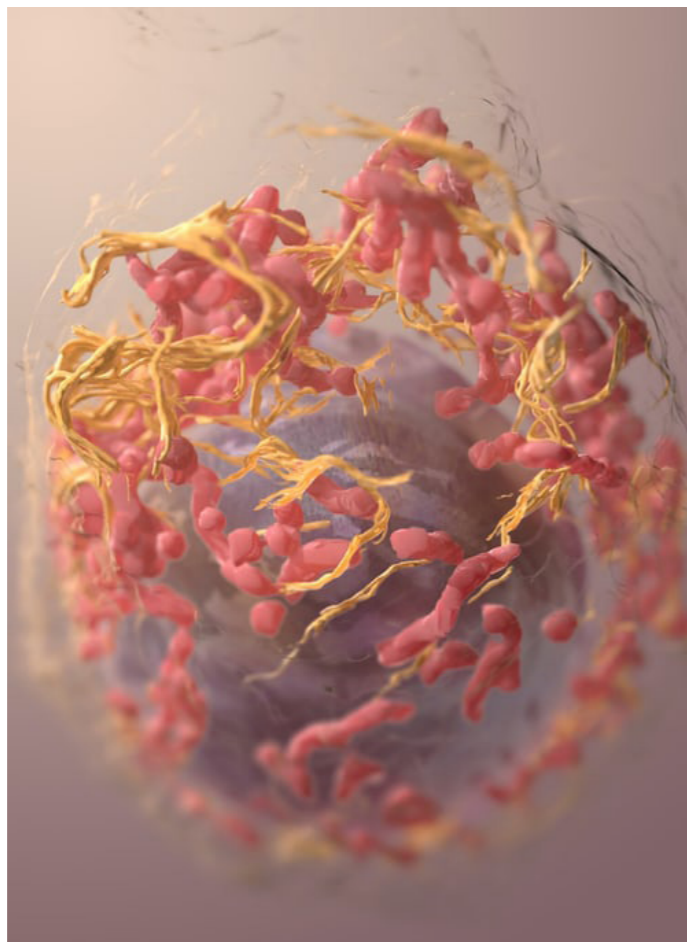
Orchids are popular for their beautiful flowers world-wide. But, did you ever think that there's more to them apart from their ornamental value? Read on to know about the medicinal importance of these plants and their potential usage for cancer treatment in future.



Credits: Kseniia Ilinykh via Unsplash

Nature has bestowed us with an enormous diversity of medicinal plants. The different plant parts such as leaves, roots, stems and flowers serve as a diverse source of chemicals used to develop various medicinally important products. In recent years, a tremendous outburst has been seen in the world market of herbal medications. Plants have been used to treat different diseases and ailments, including stomach disorders, chest pain, arthritis, jaundice, eczema, inflammations, rheumatism, asthma, cancer etc.

Cancer is a leading cause of death worldwide and has accounted for nearly 10 million deaths in 2020 alone, according to the International Agency for Research on Cancer, World Health Organization (WHO) (Ferlay, et al. 2020). Although several synthetic drugs are available for its treatment, none of them are completely effective and possess many side effects. On the other hand, plant-based anticancer drugs have proven effective and safe for cancer treatment to some extent. 'Vinblastine' -derived from Madagascar periwinkle



Credits: National Cancer Institute via Unsplash

(Caputi, et al. 2018), is one such example of a potent plant-derived anticancer drug. However, scientists have not yet arrived at a cure for all types of cancer. Thus, numerous research groups across the globe have focused their studies on finding a natural remedy for cancer through plants.

In a recent study, scientists have suggested the possibility of exploiting orchids for the creation of new anticancer drugs. Orchids are plants possessing strikingly beautiful flowers of incredible shapes, colours, and size ranges. Though famous as affluent ornamentals, orchids were first discovered for their therapeutic properties. They find mention in various scriptures and ethnobotanical texts, consisting of traditional and

indigenous knowledge of plants (Teoh, 2019). Due to their ethnobotanical importance, several researchers from the Central Department of Botany, Tribhuvan University, Nepal, Annapurna Research Center, Nepal, Fujian Agriculture and Forestry University, China, and Sails-For-Science Foundation, Germany, did collaborative and dedicated research for three years on the therapeutic importance of different plant parts of some selected wild orchid species. They prepared the different plant extracts and then eval-

uated their anticancer potential against human cervical cancer and glioblastoma. Cervical cancer is a type of malignant tumour that starts at the cervix, the lowermost part of the uterus, while glioblastoma, also known as a brain tumour, is a type of malignant tumour affecting the brain or spine.

The research team found that plant extracts prepared from the stem of *Dendrobium transparens* (the translucent *Dendrobium*) and the whole plant of *Vanda cristata* (the comb *Vanda*) acted as toxic

agents that prevented the cancer cells from growing. These plant extracts showed a high cytotoxic effect towards the HeLa (human cervical cancer) and U251 (glioblastoma) cell lines, which are cells derived from the respective living tissues and grown in laboratory conditions. Thus, these cell lines can mimic the growth of these particular cancerous tissues. MTT colorimetric assay, a standard test to evaluate the cytotoxic potential of the extracts was used. Determined to shed more light on the topic, they identified the presence of medicinally important compounds in these extracts, thus explaining their high cytotoxic activity (Joshi, et al. 2020). These findings have been published in a peer-reviewed journal, 'Heliyon' and may lead to new insights into cancer research.

These orchid plants can be established as cancer therapeutics by exploiting their vast reserve of chemicals. However, systemized observational studies involving preclinical research and clinical trials need to be undertaken to produce pharmaceutically active forms and dosage from them. This would link the ethnobotanical knowledge to state-of-the-art research and development to facilitate new drug discovery. Thus, orchids may go a long way in fighting cancer in the future.

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Author Bio:

Arshpreet Kaur is a second-year PhD Student at the Department of Botany, Panjab University, Chandigarh. Her research work is focused on implementing the therapeutic potential of plants for human welfare. Besides research work, you can find her either with a paintbrush or a whisk.

19:00

The Thought Capsule

DEC -13

What is Cogito137?

Tune in to know from *Arunita* and *Sanskriti*.

Episode 01

YouTube LIVE
[Youtube.com/cogito137](https://www.youtube.com/cogito137)

DEC-27
19:00

What is Scicomm?

YouTube LIVE
 Episode 02

○ **LEARN ABOUT COGITO137** ○

LIVE

The Thought Capsule

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Episode 3

Jan 10 19:00

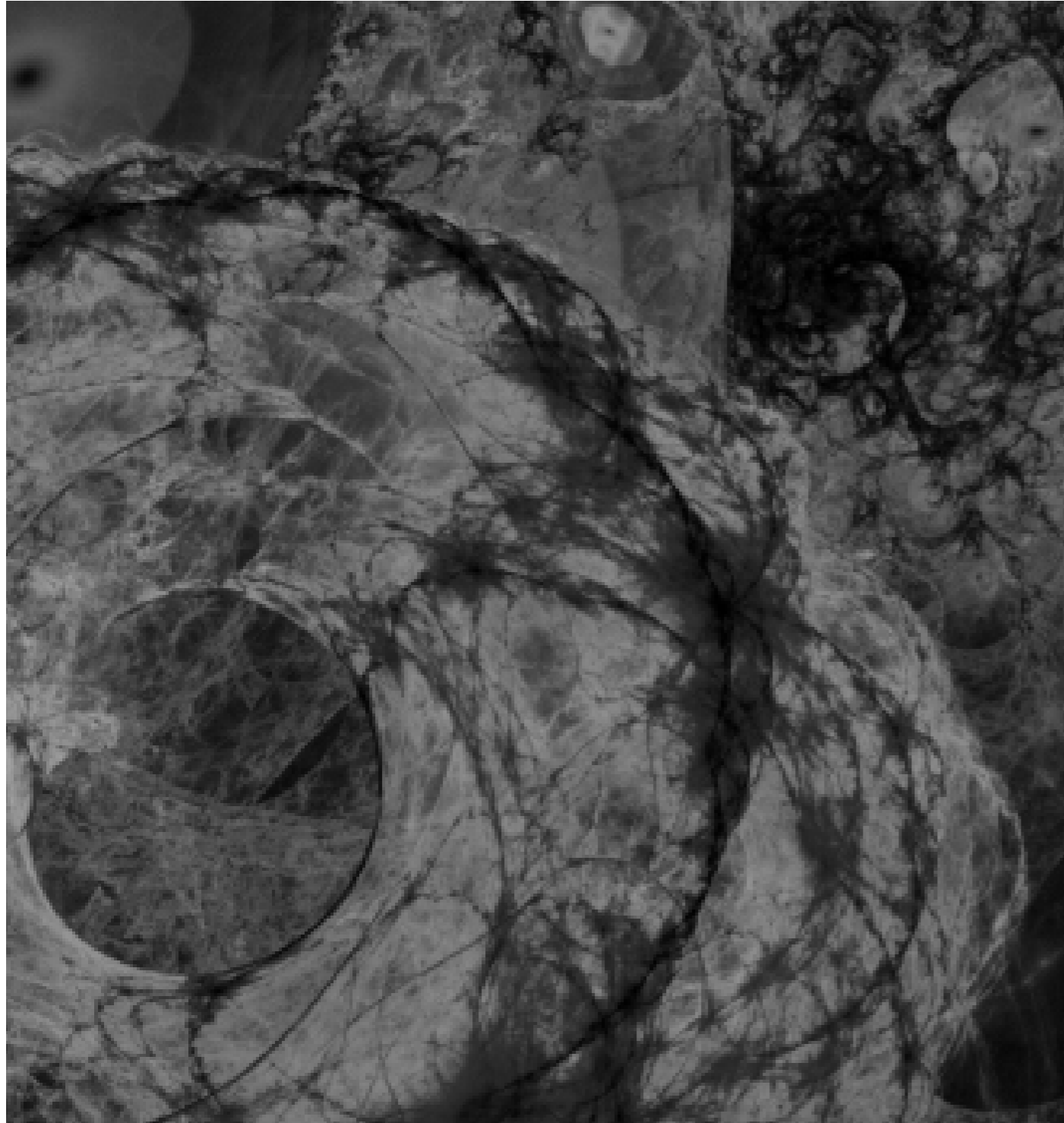
Jan-27 19:00

SCICOMM CAREERS

Episode 4

YouTube LIVE

Hosts: *Arunita* and *Sanskriti*



Credits: Ixabay

Asish Philip Monai

Dark Matter: Exotic phenomenon or convenient hypothesis?

For decades, astronomers, physicists, and cosmologists have hypothesised that the universe is made up of an exotic material known as “dark matter,” which explains the strange gravitational behaviour of galaxies and galaxy clusters. According to mathematical models, dark matter accounts for three-quarters of all matter in the universe. However, it has never been seen or fully explained. While dark matter has become the dominant theory to account for the unexplained motion of stars within galaxies, some scientists have looked for alternative explanations for why galaxies hold together these stars.

Now, an international team of scientists claims to have discovered new evidence that dark matter may not exist at all. The scientists report tiny discrepancies in the speeds of distant stars as they orbit around their galaxy. The study was published in the *Astrophysical Journal* in November of last year. They believe this shows that a faint gravitational effect, known as the Strong Equivalence Principle (SEP), breaks down. This principle states that in any freely falling local inertial frame (experiencing only gravitational forces), all physics is unaffected by the external field, including internal dynamics under

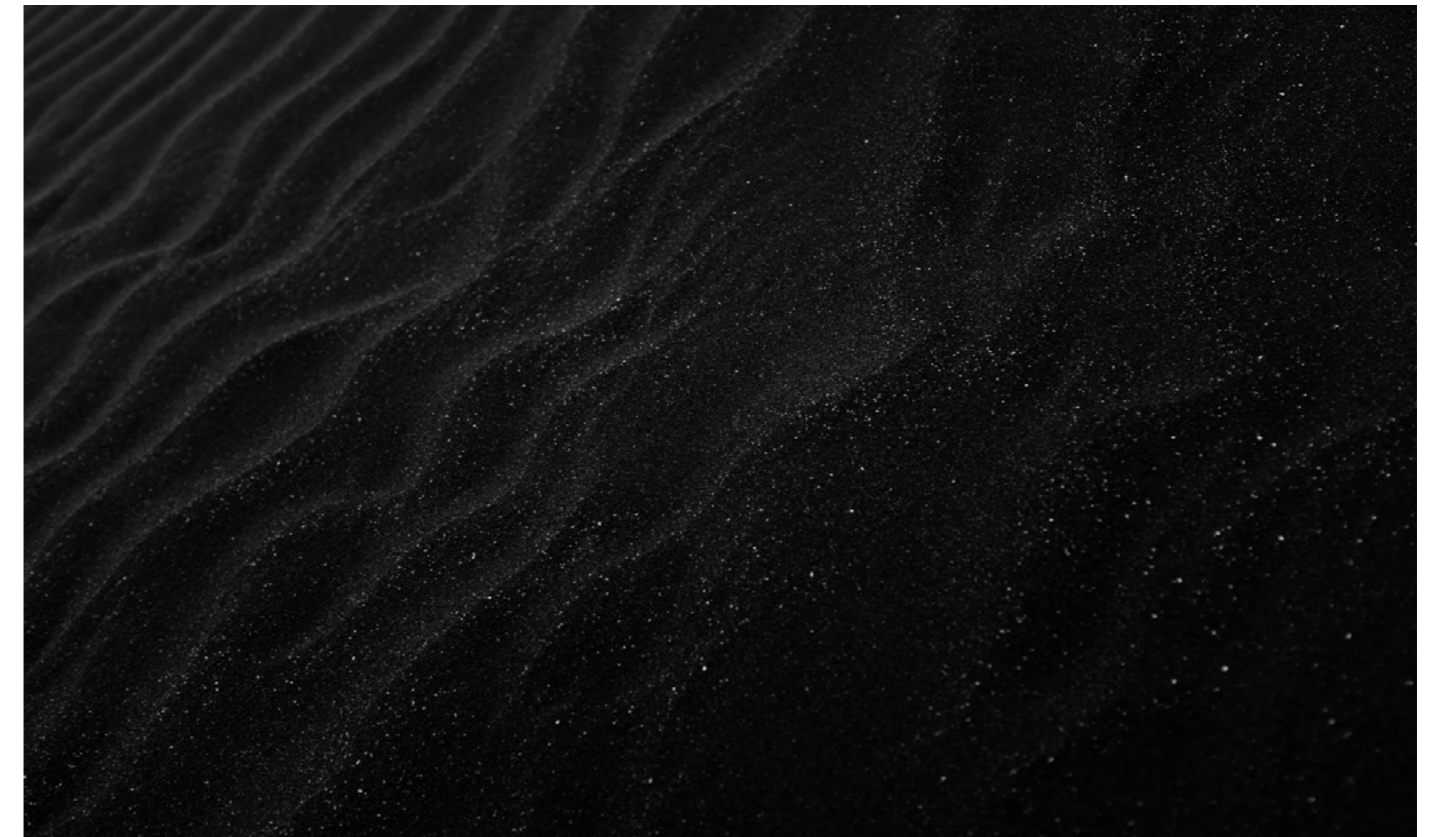
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self-gravity. In simple words, SEP tells us that if we measure the acceleration of the Solar System relative to the Milky Way, the external gravitational fields from other galaxies should not influence the measurement.

This is noteworthy because it further validates the idea known as modified Newtonian dynamics (MOND) or “modified gravity” as a feasible solution for a cosmological quandary: galaxies appear to defy the long-accepted rules of gravity traced back to Sir Isaac Newton. Newton based his theory on the fact that objects attract each other with a force that varies with their mass, something inferred based on observations of planetary orbits. It has remained astonishingly accurate with refinements from the theories of the German-born physicist Albert Einstein in the twentieth century.

However, observations of the Coma cluster of galaxies by Swiss astronomer Fritz Zwicky in the 1930s revealed that it was subject to greater-than-expected gravitational forces. When American astronomers Vera Rubin and Kent Ford discovered anomalies in star orbits in galaxies in the 1970s, many scientists hypothesised



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that they were caused by masses of invisible “dark matter” within and around galaxies, and the theory has dominated astrophysics ever since.

According to some estimates, dark matter accounts for approximately 85% of all matter in the universe. It is said to interact with light and visible matter only through gravity, and it explains anomalies observed in distant galaxies. However, it has never been observed, and no one has fully explained what it could be. Possible dark matter candidates include some weakly interacting massive particles, the oldest of black holes or even neutrinos.

The MOND theory, proposed by physicist Mordehai Milgrom in the early 1980s, states that this excess gravitational pull exists because the laws of gravity are slightly altered for such large structures. Rather than attributing the excess gravitational pull to an unseen, undetectable dark matter, MOND proposes that gravity the motions of an object in the universe should

be determined not only by the mass of the object but also by the gravitational pull of all other masses in the universe, a phenomenon known as “the external field effect” (EFE). Simply put, the spin of the Earth around the Sun is affected by the gravitational pull of every other body in the universe. The group claimed to have discovered the EFE by noticing that galaxies in strong external fields slowed (or displayed declining rotation curves) more frequently than galaxies in weaker external fields, as predicted by MOND alone.

MOND has so far withstood several scientific tests. Only time will tell if it will truly replace the undetected exotic phenomenon known as dark matter.

Reference:

Chae, K.-H., Lelli, F., Desmond, H., McGaugh, S. S., Li, P., and Schombert, J. M., “Testing the Strong Equivalence Principle: Detection of the External Field Effect in Rotationally Supported Galaxies”, *The Astrophysical Journal*, vol. 904, no. 1, 2020. doi:10.3847/1538-4357/abbb96.

Author bio:

Asish Philip is an M.Sc graduate in Astrophysics from St. Xavier's College, Mumbai. His research interest lies in observational astronomy, particularly the study of binary stars and exoplanets.

Apeksha Srivastava

COVID-19's Impact on Environment: Heroic or Villainous?

The coronavirus pandemic has turned our lives upside-down. Life as we knew it, changed considerably since the onset of the lockdowns and mobility restrictions. Have you wondered whether its effects on our environment could be positive or negative?



Clean-up divers are finding increasing amounts of COVID-19 waste in water bodies. Image Source: World Economic Forum

Provided by Author

In the 21st century, pollution soars high on the list of myriad concerns threatening life on earth. Incessant contamination of the environment from man-made sources, damaging the quality of air, water and land, has led to 9,000,000 premature deaths globally in 2015. With the onset of COVID-19, lockdowns ensued, imposing certain restrictions on human activities in general. The question arises: whether these “steps” can help or hinder the global environment “clean-up?”

Human activities are the primary source of pollutants such as industrial waste, vehicular smoke, pesticides, loud noise, and trash from homes and hospitals. But, many pandemic prevention measures have affected the scope of these interactions and activities. To probe this aspect, researchers from Ecuador and Mexico conducted

a study in 2020. Reported in Science of the Total Environment, it highlighted the considerable decrease of atmospheric pollutant levels in China after COVID mitigation measures were put in place. Nitrogen dioxide (NO₂) levels decreased by 40%, and particulate matter (PM) levels by 20-30%. NO₂ is a gaseous air pollutant found in chimney smoke of factories and vehicular exhausts. PM, found in the same sources, is a mixture of suspended particles and liquid droplets. Satellite images showed that the concentrations of these pollutants also decreased in European cities. Several beaches worldwide looked cleaner. Restrained commercial and transportation activities caused a considerable reduction in noise pollution levels as well.

Another study conducted by Indian researchers in the same year, reported in Environmental Re-

search, stated that NO₂ concentrations dropped by 40-50% across major cities of India since the onset of the nationwide lockdown. PM levels reduced by more than 50%. Air Quality Index (AQI), a measure indicating the extent of air pollution, improved during this time period, with New Delhi demonstrating an AQI of 94, while pre-lockdown values ranged between 300-400. The amount of oxygen dissolved in the river Ganga rose by 20-30% at Varanasi. River Yamuna also appeared cleaner after years.

However, the other side of the coin tells a different story.

Some practices to limit the spread of this highly infectious disease include covering mouth and nose with masks, frequent handwashing, vaccination, social distancing, isolating suspected/con-

-firmed cases, stay-at-home recommendations and lockdowns. The lockdown led to increased online shopping and food ordering, causing a substantial rise in domestic waste generation. Medical waste also witnessed a similar upsurge due to the sudden increased usage of personal protective gears like masks and gloves. Panic shopping has caused a surge in the circulation of single-use plastic bags. Multiple waste management programmes even remained suspended globally because the centers did not want the infection to spread to their sites.

This makes COVID-19's impact on the environment seem like a double-edged sword. The pandemic-triggered lockdowns, most definitely gave nature a short recovery time. But the hero, which seemed to have defeated the villain temporarily, itself came with other negative costs and turned



Provided by Author

out to be another potential villain. Hence, stay-at-home regulations are clearly not a permanent solution to our pollution problem.

Neeldhara Misra, a faculty member of the Computer Science and Engineering discipline at the Indian Institute of Technology Gandhinagar, remarks, "One of the possible solutions could be collaborative research on drones, autonomous vehicles, and ride-sharing services that aim to optimize supply chain economics as well as control pollution in the future. Nonetheless, it is just the beginning, and a lot still remains to be planned and accomplished."

These studies show the need to be cognizant of the effect of human activities on the environ-

ment and the urgency for immediate modifications for achieving a persistent decline in global pollution. Countries should also prioritize proper management of waste generated due to the COVID-19 pandemic and its mitigation measures, before the problem reaches a magnitude beyond control.

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Author Bio:

Apeksha Srivastava completed her M.Tech in Biological Engineering from the Indian Institute of Technology Gandhinagar, Gujarat, India. She is currently an aspiring science writer and a second-year Ph.D. candidate at this institute. Her research area lies at the intersection of science communication, and psychology.



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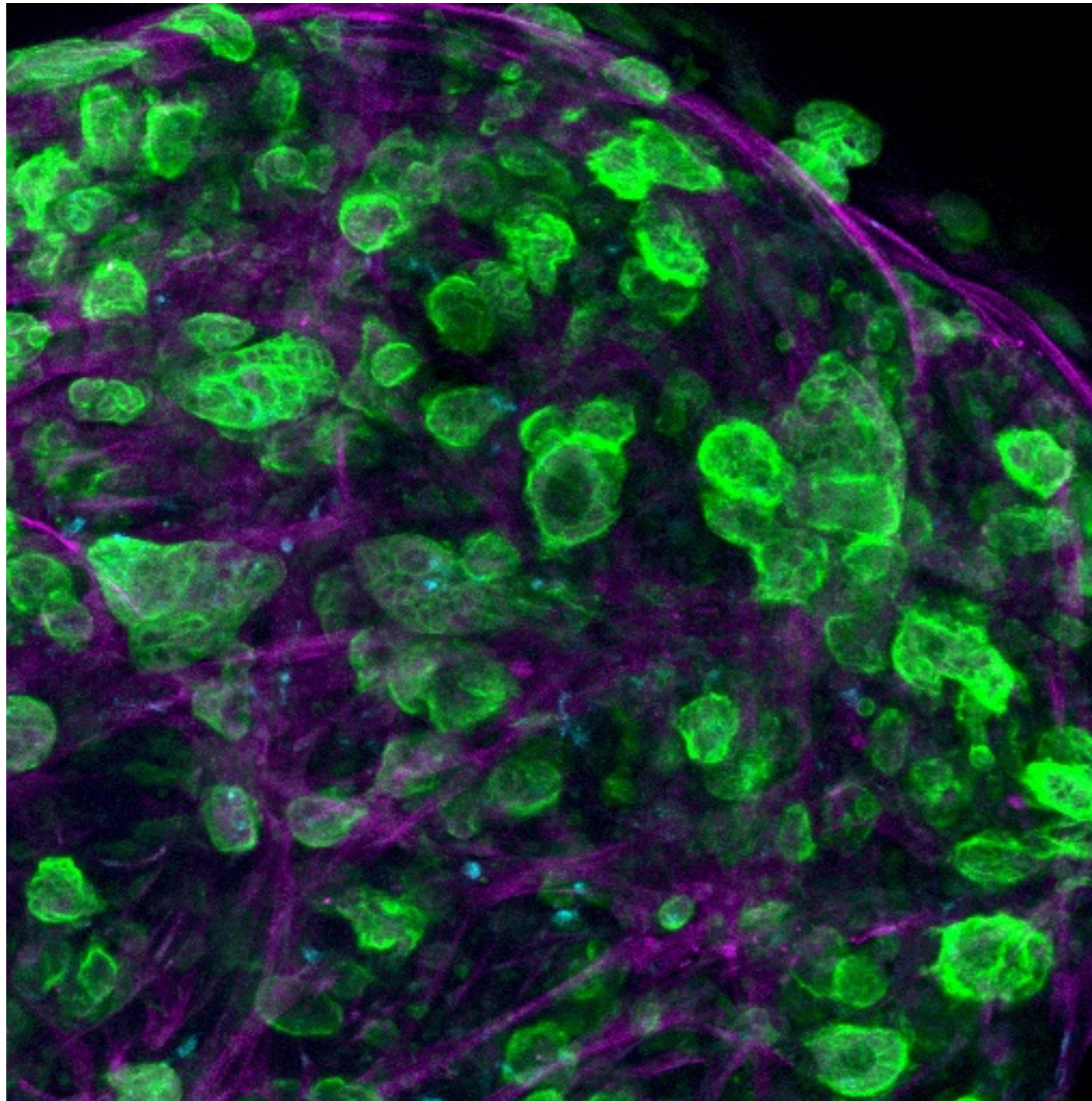
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ON YOUTUBE



Shutting off the transfer of nutrients from the neighbouring cells to the tumour is an effective way of controlling tumour growth in pancreatic cancer. Rapidly growing pancreatic tumours obtain nutrients by capturing nutrients from nearby cells. This article discusses therapeutic techniques based on this strategy.



Pancreatic Ductal Adenocarcinoma
Credits: Prof. Alvaro Mata
University of Nottingham

Kevin Philip Sabu

Starving your neighbours: shrinking pancreatic tumours

The pancreas is an organ that lies in the lower abdomen. This organ discharges enzymes that assist in digestion and secretes blood sugar-regulating hormones. Pancreatic cancer is assessed as one of the heftiest cancer assassins globally. Out of 53,000 Americans diagnosed, 41,000 of them succumbed to pancreatic cancer.

“There are two major reasons why pancreatic cancer is difficult to attack. The first reason is that it is possible to diagnose it at a late stage of the disease. The second is that we need better drugs; the current therapeutics are not that effective,” says Cosimo Commisso, the senior author of the study. The pancreatic tumour is exposed to a minimal nutrient environment. But they procure nutrients from the thick connective cells that surround them. So, starving these cells will hinder tumour growth.

Commisso’s group started focusing on the methods that can be used to starve these neighbouring cells that promote cancer growth. If the neighbours are starved, nutrient supply for tumour cells by them can be inhibited. The amount of amino acid glutamine present is inversely proportional to the nutrient uptake.

When there is a deprivation of the amino acid Glutamine, it stimulates the nutrient uptake in cancer cells. This nutrient performs two functions. They serve as a source of amino acid associated with the surrounding neighbouring cells’ well-being and provide amino acids that enhance tumour growth.

Initially, they blocked this nutrient uptake process in those cells by blocking the enhancement of cytosolic Ca²⁺ by treating them with a certain chemical. This ‘cell drinking’ inhibited cells, and the tumour cells were switched to the model animal (mice). The result obtained was unforeseen. The tumour growth was slowed in the test mice in which the nutrient uptake was inhibited compared to the other mice in which it was not inhibited.

Peeling off these nutrient-supplying cells completely will only advance the spreading of the tumour. So, if targeted drugs that can inhibit this nutrient uptake are launched, it will be a breakthrough. In their long-term examination, they also pointed out the molecules which trig-



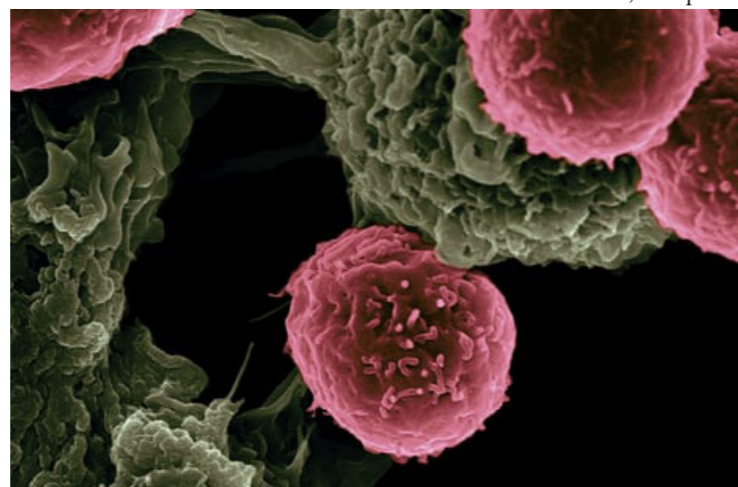
Made by Author

ger this nutrient uptake from the neighbouring cells of the tumour, which is an additional advantage in drug discovery. So, this investigation can be a breakthrough for many of the devastating malignancies such as lung, prostate, bladder, and colon cancers.

Commisso’s team has found that systemic inhibition of macropinocytosis by administration of EIPA leads to a tremendous decline in tumour growth in a xenograft mouse model of PDAC. Cancer-associated fibroblasts in these cells also had considerable effects of growth deprivation when treated with EIPA because this chemical inhibits the nutrient uptake of the tumour cells.

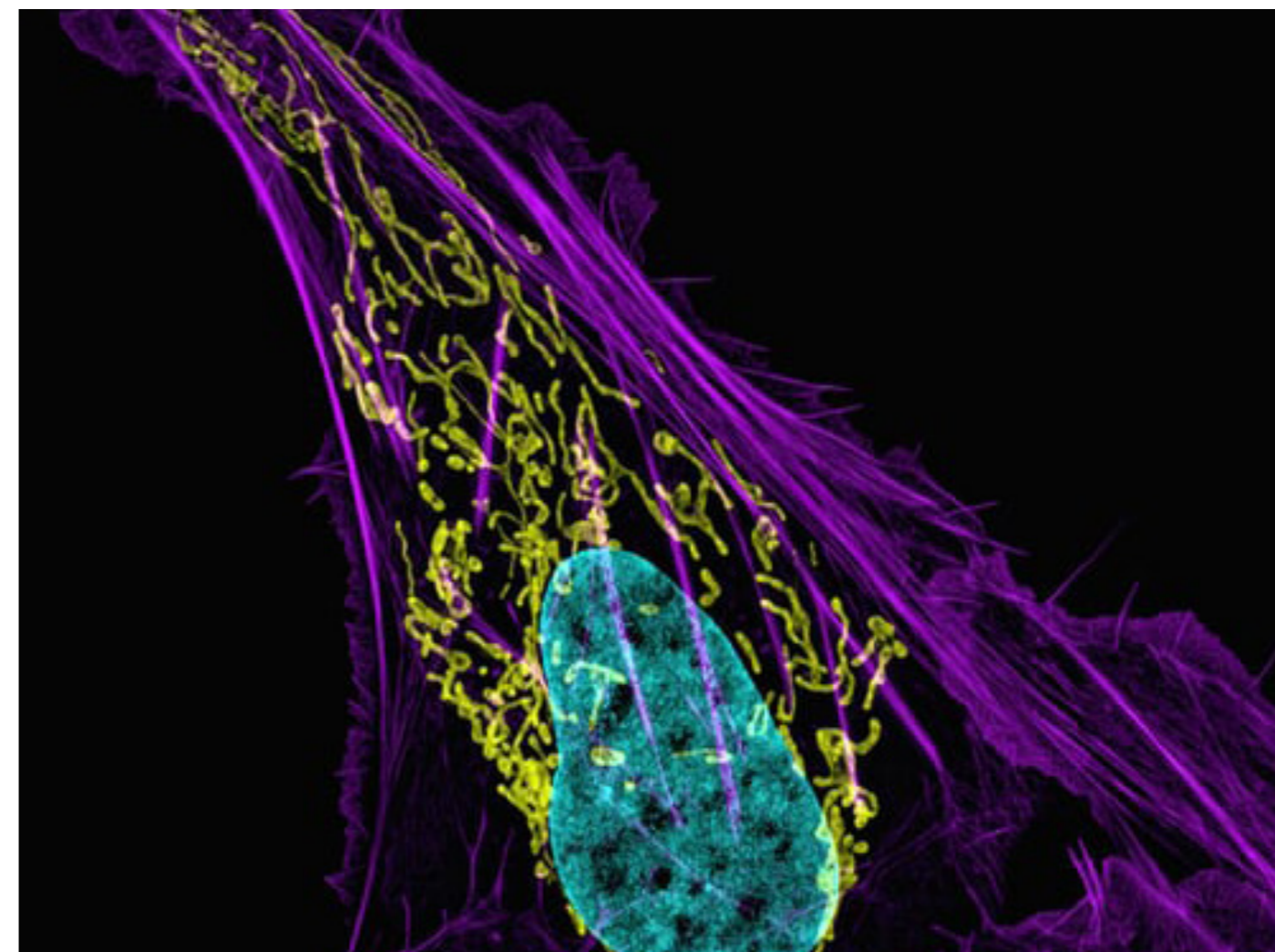
“We are going to test whether cutting off the nutrient supply will actually be combined with chemotherapies, in the hope of creating a new and improved way of treating patients”, Commisso said. They are operating on drugs that can target these neighbouring cells. With that, they will have an entrance to the tumour so that chemotherapy can effectively control pancreatic cancer.

Credits: National Cancer Institute, Unsplash



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2. SBP’s Cosimo Commisso talks pancreatic cancer; DOI: <https://youtu.be/sPONPdbSj14>



Credits: Unsplash

Author Bio:

Kevin Philip Sabu is a final year MSc Zoology student in the School of Life Sciences, University of Madras. He is currently pursuing a Master’s thesis, investigating the different bioassays of secondary metabolites isolated from gut bacteria. His research interests are in the diverse fields of Biology and Organic Chemistry. Apart from science, he loves hanging out and reading books.

Bhavana Sitaphale

Did you know our tired brain cells can alter our perception of time?

Slow or fast— How does your brain perceives 'time'?

We are familiar with the feeling of time flying away too fast or moving too slow. This article discusses how our brain perceives and processes this distortion.



Credits: By Author



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Have you ever come across a situation when time seems to fly? Especially when we are doing something we really enjoy. But contrary to this, when we are doing something that doesn't interest us, time seems to drag. Why does this exactly happen? Masamichi J. Hayashi and Richard B. Ivry from University of California have discovered a mechanism that explains this distortion in perception of time.

For their study, they took a sample of 20 right-handed volunteers and asked them to perform a duration discrimination task. A grey circle was displayed on the semi-transparent screen and the participants were supposed to judge the duration of the stimulus, meaning for how long the grey circle appeared on the screen. The participants were exposed to an adaptive stimulus before the actual test stimulus. There were three adaptive phases: short duration, long duration and no duration. For short duration the grey circle was displayed on the screen for 250 milliseconds and for long duration it was displayed for 720 milliseconds, for 30 times each. They were required to judge the test stimulus relative to the reference adaptive stimulus. Behaviorally, this adaptive stimulus produced striking after-effects. It was observed that when participants were subjected to a short adaptive phase they most likely judged the test stimulus long, whereas when they were subjected to a long adaptive

phase they judged it short. Even if there has been considerable psychological study done on these after effects, there has not been enough research done on which area of the brain is involved in producing these aftereffects.

While participants were performing the task their brain activity was measured using Functional Magnetic Resonance Technique (fMRI). The fMRI is a sort of neuroimaging method in which the brain is exposed to multiple magnetic fields. The protons of hydrogen atoms respond to these magnetic fields by generating an electromagnetic signal which is then received by the scanner and a high resolution image of the brain is produced. Furthermore, the fMRI scanner can detect the differences in the oxygenated and deoxygenated blood by using a method called Blood-Oxygenation-Level-Dependent (BOLD). More active areas of the brain tend to receive more oxygen and thus BOLD enables us to understand which area of the brain is responsible for a particular activity.

The fMRI results showed strong physiological evidence that the right supramarginal gyrus (SMG) part of the parietal lobe of our brain reflects our subjective experience of time. Neurons in SMG fire for a specific length of time enabling us to precisely represent time. When we are repeatedly exposed to a stimulus of a fixed

duration, our neurons in SMG get tired. But all the neurons in the other parts of our brain function normally. Therefore, we can say that it is due to these neurons in SMG that we experience this distortion of time.



Credits: Unsplash

The subjective sense of time is an elementary dimension of our sensory experience. Our ability to accurately represent time is important for optimization of our perception and motor control. It is amazing that our human brain can represent time with such precision and Masamichi J. Hayashi and Richard B. Ivry with their intensive research are able to explain how our brain does that. This research perhaps will unlock many mysteries and will help us understand the functioning of our brain.

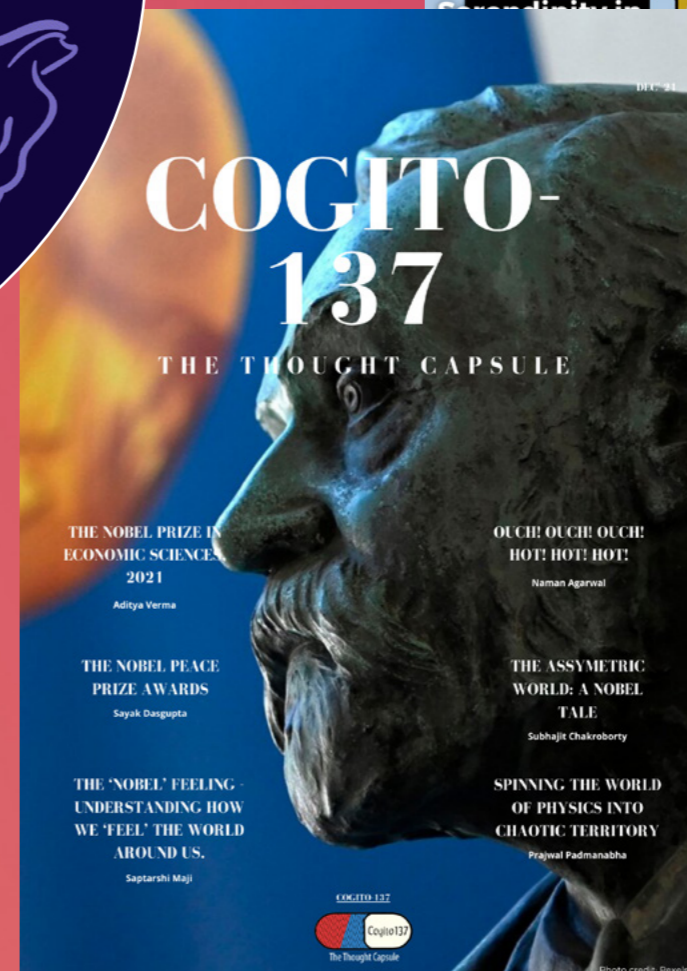
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Author's Bio:

Bhavana Sitaphale is currently pursuing a Master of Science in Physics at the University of Cologne in Germany. Her research interest lies in Biophysics.

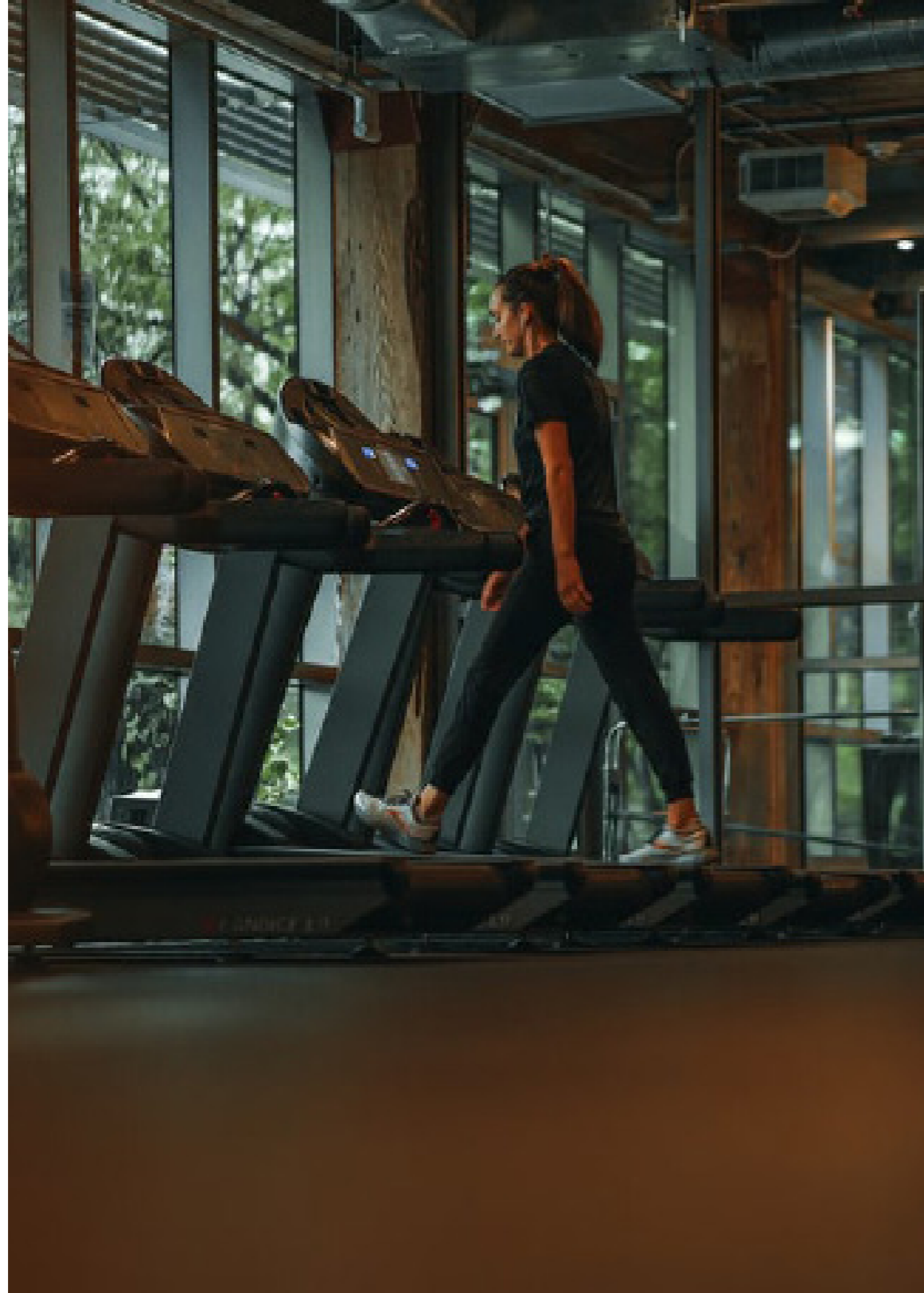
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A precise method of monitoring fat metabolism by breath analysis, which has application in detection of global diseases like diabetes.



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Sakshi Hardaha

A compact and cost-effective device developed to monitor body-fat burning

Acetone- a biomarker of fat metabolism.

Fat is an essential component of our diet. But its overconsumption can make us obese and create more problems if one has diseases like diabetes. Exercising is one of the solutions. It has been shown that weight loss decreases the severity of diabetes in the patients¹. But the impact of exercise varies from person to person. So, how do you know up to what extent your body is burning fat while exercising?

“Precise measurements of acetone gas concentration allow us to determine the body’s ability to metabolize fat and develop exercise methods for efficient fat burning”, tells Professor Yuji Matsuura, head of the research team to EurekAlert.

The concept of breath acetone measurement to monitor fat burning is not new. When you exercise, your body breaks fat into various products. One of them is acetone. On burning fat, acetone concentration increases and can be detected. Previous studies mention devices based on this concept but they are large, expensive, or less accurate. What is new in the device designed by Matsuura’s team is that it is compact, cost-effective, and can detect as low as 0.024 ppm of acetone (i.e., 24 molecules of acetone per 1000 million molecules of the breath sample), an impressive accuracy.

The device uses no vacuum components and the breath sample is collected in simple polyethylene bags that cut the price down. Vacuum components were of no use as there was no absorption of air at 195 nm wavelength to disturb the measurement of acetone in breath. The use of only three components made the device compact. Now how does the device work? The general concept behind the device is spectroscopy, a technique based on a principle that when the light of



The setup of the device- Reference- EurekAlert

characteristic wavelength strikes the molecules of the sample, some of it gets absorbed by the sample and the rest passes out. The amount of light passing out can be detected using a light-sensitive device (it generates electric current when light falls upon it, that further is amplified and recorded by an ammeter or a pen-recorder) which conveys the signal to the monitor. In turn, the monitor displays the amount of light absorbed which is the difference between total light and light passing out of the sample. The absorption of light is related to the concentration of different molecules in the sample. Thus, a graphical comparison of the absorption value of the breath sample after exercise with the value without exercise indicates the amount of fat burning in the body.

A cherry on the top is that the device can also be used for bloodless diagnosis of diabetes. In diabetes, body cells cannot utilize glucose for energy so they start using fats. Breakdown of fats increases acetone concentration in breath from normal 0.3-1.2 ppm value to 1-10 ppm. Detection of an increase in breath acetone concentration provides an easy diagnosis of diabetes. Besides this, other breath components like



Simple schematic representation of three main components in the device. A deuterium lamp source produces light of 160-400 nm wavelength. A gas cell where a breath sample is introduced. A spectrometer to measure the absorption of light.



Credits: Pexels

isoprene can also be simultaneously detected. Isoprene is related to the synthesis of cholesterol in the body. Hence, its altered levels can be used in the diagnosis of diseases that involve cholesterol. Along with these prospects, the device can help in choosing a better weight loss routine with better disease management.

The research was done at Tohoku University, Japan under Yuji Matsuura. The findings are published in ‘Sensors Journal’ under the title ‘Vacuum Ultraviolet Absorption Spectroscopy

Analysis of Breath Acetone Using a Hollow Optical Fiber Gas Cell’.

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4. Diagnostic potential of breath analysis—focus on volatile organic compounds Wolfram Miekisch

Author’s Bio:

Sakshi Hardaha, from Raipur, Chhattisgarh is doing her Masters in Biotechnology from Pondicherry University. She enjoys learning new things in life. Science piques her interest in learning more about what’s going on in the world and the concepts that underpin it. An opportunity to attend science communication seminars led by Vigyaan Prasara and Cogito137, got her interested in the field. She also shares fascinating stuff as a blog called ‘Science Flakes-News easy to digest.’ Besides, she enjoys baking, painting, and surfing around social media in her spare time.

Anjira Sengupta

Best Friends or Best Parents? How Pet Dogs Perceive Us

This pandemic has confined us to our homes and abruptly interrupted our daily social gatherings. It might have been a little easier for people with pets at home. This article focuses on pet dogs and how our furry roommates perceive us, and how that might differ from their perception of other companion dogs living in the same house.



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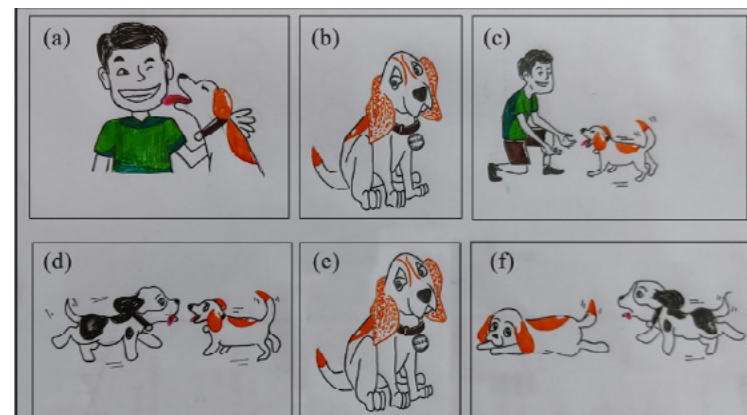
Let's walk down memory lane and imagine a late night in the pre-pandemic era. After a long and grueling day at work, you return home and open your door wearily. And, there they are! Your dogs, sitting right in front of you with their glowing puppy eyes. Their ecstatic welcome washes away all your exhaustion, and their contagious energy replenishes yours.

But it's not just you who finds this reunion refreshing. When you come back home, your furry pet feels the most secure around you, as well. Even more secure than the presence of any other companion dog.

You might wonder, "Can an animal really feel more comfortable around me than someone from its own species?" Dr. Monique Udell and her research group from the Oregon State University, USA, wondered the same. For the past eight years, they have been studying the interactions between humans and animals. Their recent study enlightens us about the relationship among companion dogs in a household and their primary caregivers - humans.

Researchers in the past have uncovered a surprising bonding pattern between adult pet dogs and humans: pet dogs seek security in their owners like children would in their parents.[2] Dr. Udell's group tried figuring out if adult dogs living in the same house had a similar pattern among themselves.[1]

To test their theory, they designed an experiment. Let's imagine two companion dogs, Goldie and Blackie, who live with their owner Ron. Ron



Picture 1: The experimental setups

first takes Goldie to a room they never went into before. He interacts freely with Goldie ((a) in picture:1) and leaves the room after 2 minutes, leaving the dog behind (b). After 2 minutes of



Credits: Pexels

separation, Ron comes back and again starts interacting with Goldie for 2 minutes (c), just like earlier. Ron leaves again after 2 minutes of the reunion. Now, a volunteer brings Blackie into the room and leaves him with Goldie for 2 minutes (d). Then the volunteer takes Blackie outside (e) and brings him back after another 2 minutes of interval (f). You might have noticed Goldie's behaviour change throughout the experiment. Udell's group repeated this same experiment with 24 pairs of dogs and their caregivers. Similar to previous results, they found that dogs sought human presence when left alone. But, even in the presence of their companion dogs (say Blackie), the researchers noticed that some dogs (like Goldie) kept looking for their human caregivers (Ron). Through more results, they realized that dogs in the same household bonded like siblings. Whereas the same dogs bonded with humans like babies would with their parents.

This study shows us one of the prominent results of dog domestication. Humans kept dogs as pets, generations after generations. As dogs formed bonds with humans, they obtained through evolution many of the features and behaviours that capture our attention. Since domesticated dogs of today cannot find their food or shelter easily, bonding with humans helps them live in this ruthless world. So, enjoy the pandemic with your furry babies and spend quality time with them. Even after the

pandemic is over, try to maintain this practice with as much effort as possible. Because just as they take away all our worries and tension, they also depend on us for love and attention!

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Credits: Pexels

Author Bio:

Anjira is mostly recognized as your friendly neighborhood expert on dog behaviour. As an aspiring ethologist, she graduated from IISER Kolkata with a degree in biology in 2020 and she is set to join Louisiana State University come spring 2022 to pursue her PhD. If this gregarious woman is not explaining to you the nuances of the social dynamics of stray dogs, that's because she is probably too busy painting portraits or making miniature crochet models!

Probiotics have risen in popularity in recent years as a result of growing scientific evidence demonstrating their favourable effects on human health. This article highlights recent probiotic studies on Alzheimer's disease.



Credits: Karley Saagi, Pexels

Gunjan Sachdeva

Probiotics: Not just a mere food supplement

Probiotics have been commonly used as dietary supplements since olden days. They occur naturally in various fermented foods, such as yogurt, kimchi and sourdough bread. Probiotics are living microbes that are good for our overall health. They operate by competing out harmful bacteria, occupying space and depleting the resources pathogens need to reproduce. They produce a variety of beneficial molecules along the digestive tract that nourish gut cells and assist in the creation of the gut barrier, which prevents disease-causing bacteria from travelling to other parts of the body. A team of scientists have revealed interesting findings regarding the anti-Alzheimer properties of *Lactobacillus plantarum* (a probiotic).

In 1965, Lilly and Stillwell coined the term 'probiotic' to describe "the growth-promoting substances generated by microbes." Following that, several scientists came up with their own definitions of probiotics. In 2012, the World Health Organisation (WHO) defined probiotics as "microbial cells that, when provided in suitable proportions, impart a benefit to the host". In a research it has been revealed that the *Lactobacillus* genus of bacteria contains the majority of strains that have the potential to help with antibiotic-associated diarrhoea, inflammatory bowel disease of the intestine, gut microbe's restoration and irritable bowel syndrome. *Lactobacillus plantarum* displayed anti-Alzheimer properties when tested against Alzheimer's disease (AD) caused due to excess of D-galactose. D-galactose is found in large quantities in milk, vegetables, and fruits. Prolonged D-galactose intake tends to interact with proteins present in our body resulting in the formation of unstable compounds which can have disastrous consequences. Alzheimer's disease is a neurodegenerative ailment in which brain functioning is impeded by the death of brain cells, and the patient experiences memory loss as well as loss of coordination in other mental processes. This disease mostly affects those over the age of 65. Researchers from both studies within an organism and outside a living organism discovered that *L. plantarum* can produce signals from the brain to various parts of the body that are vital for brain functioning. Furthermore, in rat brains affected by Alzheimer disease, this probiotic showed a positive effect on the transport of numerous proteins across the brain. Additionally, this probiotic can protect AD-induced rats from



Credits: Nathan Dumlo, Pexels

excess free radicals generated in the body that can damage proteins, cells and DNA, indicating its antioxidant properties. A research carried out by Mallikarjuna, who is a research scholar at Sri Venkateswara University, Tirupati, used these features of *L. plantarum* to test for its anti-Alzheimer effects.

Results showed that the *L. plantarum* probiotic can improve behavioural activity and learning skills in Alzheimer's patients by increasing brain signalling activity in the hippocampus (involved in memory) and cerebral cortex (awareness, perception) regions of the brain, as well as restoring the brain abnormalities to normal levels. However, it is unclear whether *L. plantarum* can restore the changes (loss of beneficial microorganisms) that occur in the intestine after encountering Alzheimer's disease. More research is needed to fully understand the positive effects of *Lactobacillus* bacteria for treating various disorders.

All of these exploratory data indicate that *L. plantarum* probiotic has an anti-Alzheimer's impact against D-Galactose-induced Alzheimer's disease.

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Author Bio:

Gunjan Sachdeva, recently completed her post graduation in Biotechnology from Delhi Technological University. She is an introvert who keeps herself occupied with a variety of activities such as painting, penning quotations, tales (authored a book "Joy in a Coin") and, most importantly, composing poems. She had not only limited herself to these pastimes, but has now also taken up cooking and dancing in her spare time.

Her Curiosity has remained associated with academics, and she adds that curiosity is what transforms us from ordinary people to remarkable personalities, therefore one should always have it, whether in academics or non-academics. Now she is planning to go for higher studies in her dream subject. Thanks for reading !

Biology Week IISER KOLKATA CHAPTER
A Royal Society of Biology Showcase Event

05/10
6:30 - 7:30 PM (IST)

Project Namoste: What Might Be Killing The Dairy Industry and How We Can Prevent It

Shreyash Borkar
BS-MS Student, IISER Kolkata (Team Cogito137)

<https://www.youtube.com/c/Cogito137>

Biology Week IISER KOLKATA CHAPTER
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06/10
12:30 - 1:30 PM (IST)

How Our Brain Makes Conscious Experiences

Dr. Nao Tsuchiya
Professor of Psychology, Monash University

<https://www.youtube.com/c/Cogito137>

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07/10
6:30 - 7:30 PM (IST)

Insect Communication

Dr. Bittu Kaveri Rajaraman
Associate Professor of Biology and Psychology, Ashoka University

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Biology Week IISER KOLKATA CHAPTER
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 Alekhya Integrated PhD Student, IISER Kolkata (Team Cogito137) 08/10	 Shreyash Borkar BS-MS Student, IISER Kolkata (Team Cogito137/ Team iGEM) 05/10	 Nirmitee Mulay & Arunima V. BS-MS Student, IISER Kolkata (Team Cogito137) 10/10

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08/10
7:00 - 8:00 PM (IST)

Science Accessibility using Origami: an Introduction to Foldscope

Alekhya
Integrated PhD Student, IISER Kolkata (Team Cogito137, Team Foldscope)

<https://www.youtube.com/c/Cogito137>

Biology Week IISER KOLKATA CHAPTER
A Royal Society of Biology Showcase Event

09/10
4:00 - 5:00 PM (IST)

Living Among Humans - The Lives of Dogs

Dr. Anindita Bhadra
Associate Professor, Dept of Biology, IISER Kolkata

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Biology Week IISER KOLKATA CHAPTER
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10/10
6:30 - 7:30 PM (IST)

From Textbook to Canvas - Taking Biology Everywhere

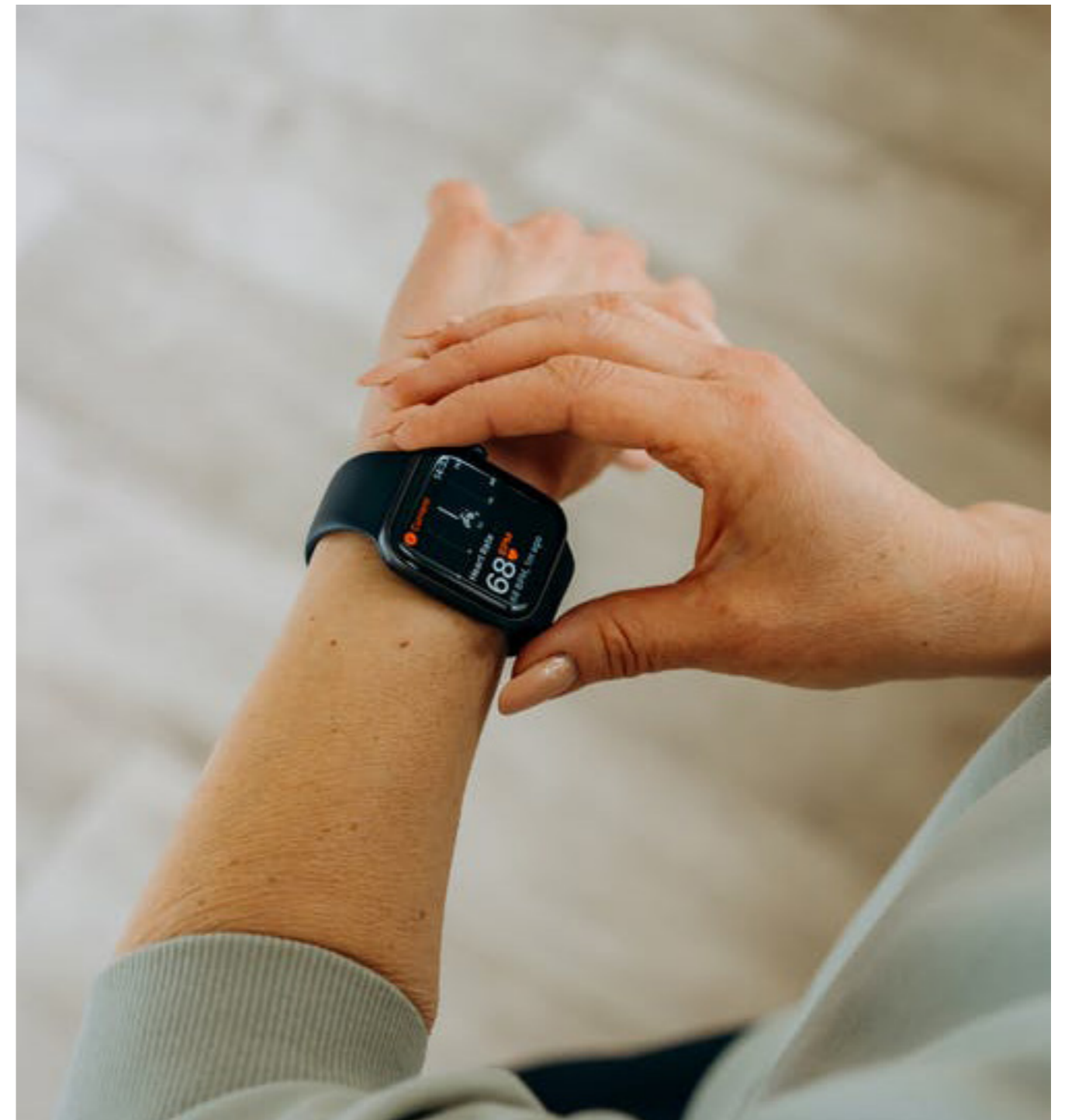
Nirmitee Mulay & Arunima V.
BS-MS Student, IISER Kolkata (Team Cogito137)

<https://www.youtube.com/c/Cogito137>

Akshatha N. S.

Smartwatches are the new doctors: Diagnosis made easy

Gadgets have taken a large portion of our lives and made us comfy. Smartwatches, a fashion gadget, can do many more things than time-telling. This article unravels the outcomes of an interesting study that gives a proof-of-concept of smartwatches as better health predictors.



Credits: Mikhail Nilov, Pexels

In today's digital world, wearable sensors like smartwatches, Fitbit, and smart finger rings have started to take over the digital market as personalised health monitors. They have become popular primarily for their style and convenience in a growing trend. Apart from telling the time, these watches track our day-to-day actions while also checking important health parameters such as heartbeat, blood pressure, oxygen concentration, and many more.

A recent research study published in Nature Medicine emphasises the role of smartwatches as a potential tool in the diagnosis of health issues. Researchers and biomedical engineers from Duke University and Stanford University collaboratively conceived this study to prove the ability of wearable sensors to precisely predict health databases of individuals in similar lines with invasive clinical laboratory tests, using long term data.

The study started in 2015 with 54 patients who were given an Intel Basis smartwatch to wear for three years. Predetermined parameters such as physical activity, heart rate at rest, body temperature, and sweat production via electrodermal activity were continuously monitored via

Credits: Karolina Grabowska, Pexels



the smartwatch. Simultaneously, standard blood tests, including haemoglobin, RBC and platelet counts, and blood glucose levels, were routinely monitored in diagnostic lab tests.

The study shows the improved and consistent results of smartwatches compared to laboratory results. Surprisingly, resting heart rate showed more consistency and accuracy with smartwatches over clinical tests, which could be the result of a non-anxiety environment and constant test time. In contrast, clinical tests better determined body temperature than the superficial skin temperature on smartwatches. In addition, dehydration levels, changes in red blood cells, glucose, and iron were also monitored during the study, showing promising accuracy in predicting health burdens such as symptoms of flu and anaemia.

Researchers say this is a proof of concept of the need for continuous monitoring to predict a person's health. Although laboratory diagnostic tests are specific and accurate, the major drawback lies in irregular tests. These tests reflect a person's health status at a single time point (time of testing) and are hence less effective than continuous monitoring. For a person with



Credits: Cottonbro, Pexels

chronic illness, monitoring health parameters on a routine basis becomes necessary, where smartwatches can be of great help. The information from smartwatches can be correlated to illness. For instance, when there's a high body temperature with no body movement, the person can be diagnosed with flu. Decreased heart rate can be a sign of heart-related complications.

The study found a significant difference between the continuous versus scheduled monitoring of health parameters on smartwatches and laboratory visits, respectively, over the same health signs. Evidently, daily variation in the body, which clinical labs fail to monitor, can be tracked by the smartwatches and raise the alarm when the body crosses the normal baselines, which might need immediate clinical investigations. The authors are assertive on the outcomes of this unique study which is an amalgam of machine learning (a growing technology which enables computers to learn and analyse auto-

matically from past data) and precision therapy (customised healthcare that is tailored to an individual patient).

Smartwatches are not to be mistaken as a replacement for clinical tests but a platform for the early diagnosis of illness by continuous monitoring. Albeit having limitations in terms of accuracy in predicting sickness, this study significantly contributes to the arena of health monitoring systems of patients. The research team with great hope envisions that these smartwatches will be a game changer in clinical decision making, with their easy and non-invasive nature. Smartwatches in the future might be able to detect health features more accurately and fetch quick data for diagnosis.

Reference:

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Author's Bio:

Akshatha is a third-year graduate student at JSS Medical College, Mysuru, Karnataka. She is a budding biologist in Dr. Divya P. Kumar's lab, exploring the pathogenesis of the nonalcoholic fatty liver disease, a lifestyle-driven condition. She's a passionate dancer and a bibliophile with a life mantra - Be good, do good.

This article focuses on the air pollution aspect which influences COVID-19 mortality rate. It sheds light on how even a minor increase in the number of harmful air pollutants can exacerbate COVID-19's damaging consequences.

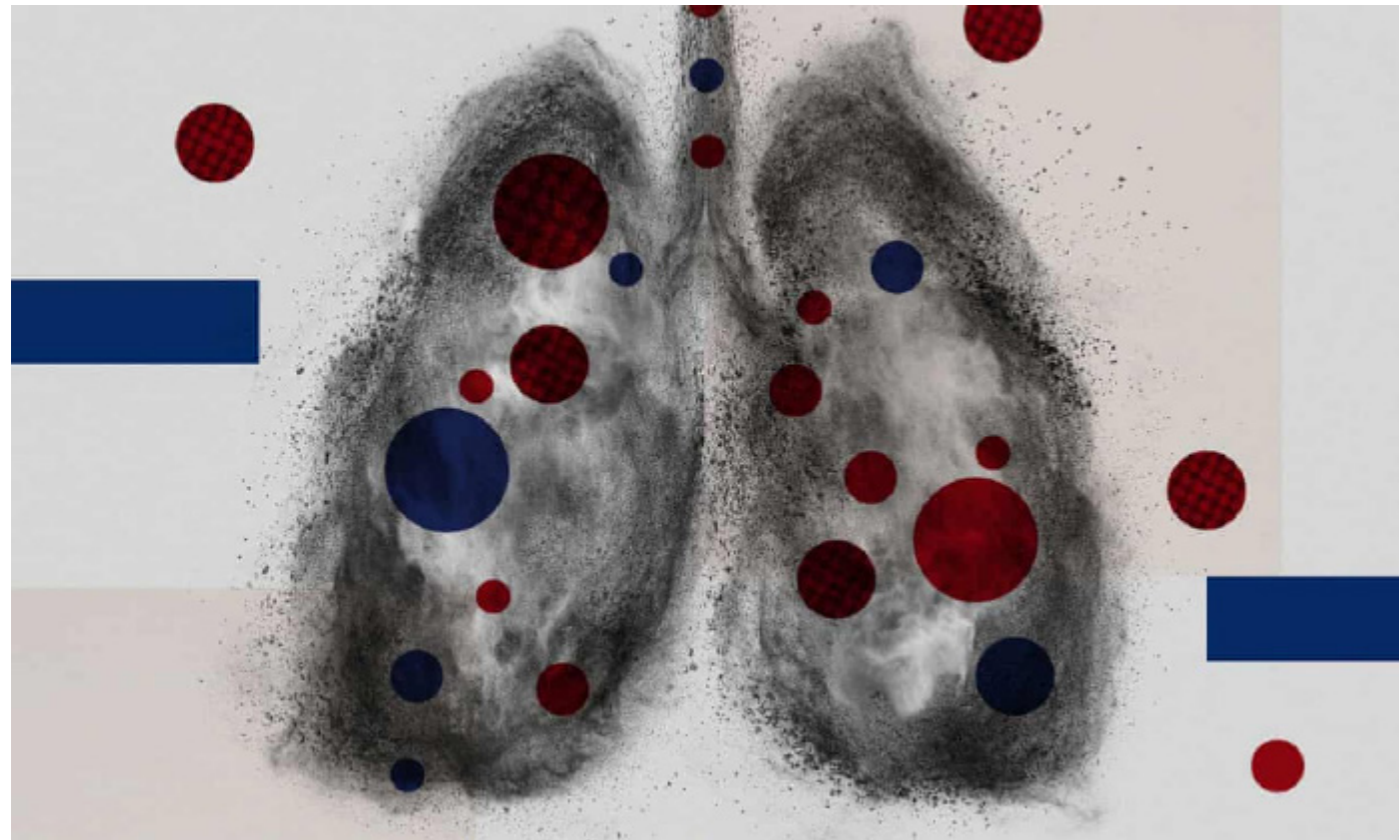


Illustration by Guardian Design

Shrushti S. Patil

Does Air Pollution Impact COVID-19 Mortality?

The world has been in the grip of the COVID-19 pandemic situation for a while now. The novel Coronavirus (SARS-CoV-2), was first discovered in December of 2019. It emerged in a wet market in China's Wuhan, where it may have spread species from another mammal to humans. Considering a case study of England, to date, over 4,467,310 instances of COVID-19 have been tabulated and more than 127,739 patients have succumbed to it. Fortunately, we have progressed in managing this disease to some extent.

With all the latest stories regarding COVID-19, researchers at the University of Cambridge have made fascinating findings. Marco Travaglio and his group found a correlation between air pollution and the COVID-19 deaths in the beginning phase of this pandemic. Their study found that a minute increase in air pollution causes COVID-19 to spread and claim more lives. Further investigation suggests that exposure to air pollution for long durations may enhance the severe effects of COVID-19.

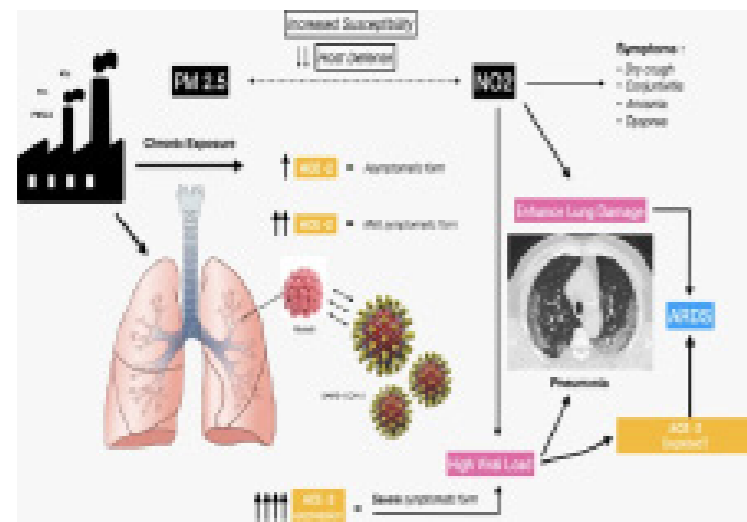


Figure: Hypothesis of the SARS-CoV-2 infection mechanisms and severe lung disease induced by the combined effect of PM 2.5 and NO2.

Human activities such as transportation, industrial processes, and mining have increased the levels of many harmful pollutants. For instance, it is true that prolonged exposure to common road transport pollutants, including nitrogen oxides and ground-level ozone, can induce oxidative stress and inflammation within the airways. This situation significantly aggravates health conditions such as asthma, chronic obstructive pulmonary disease, cardiovascular diseases, and diabetes. Consequently, air contamination has been recommended to add to COVID-19 seriousness, either straightforwardly, by compromising

the lungs' immune response to the infection, or indirectly, by exacerbating underlying respiratory or cardiovascular diseases.

For this, originally researched possible connections were investigated between regional and sub-regional variations in air pollution, population level, COVID-19-related deaths cases in England, and data was retrieved from the National Health Service (NHS). Three significant air pollutants were considered, namely, nitrogen dioxide, nitrogen oxide, and ozone, across the seven regions in England to determine the relationship between COVID-19 deaths cases.

To demonstrate this, Pozzer and his colleagues used satellite data to define fine particle exposure and estimated the anthropogenic component using an atmospheric chemistry model. The extent to which air pollution influences COVID-19 mortality was determined using epidemiology data from the United States and China. Epidemiology reveals the incidence, distribution of the disease. Based on this, they projected that air pollution contributed roughly 15% of COVID-19 mortality overall, 27% in East Asia, 19% in Europe, and 17% in North America.

Nitrogen oxides are the principal supporter of expanded quantities of COVID-19 deaths in the early phase of the pandemic. The analysis identified fine particulate matter as significant predictors of increased SARS-CoV-2 infectivity. In light of the results, it was seen that a small increase in the long-term average of nitrogen dioxide levels increased COVID-19 cases by 4.5%. Similarly, an increase in nitrogen oxides was associated with approximately 2% increased cases in England. On the other hand, ozone levels are not significant predictors of infectivity.

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Exposure to these pollutants may inhibit pulmonary antimicrobial responses, reducing clearance of the virus from the lungs and promoting infectivity. Reduced phagocytic function (ingestion of foreign body particles) is well documented after the exposure of the virus to particulate matter which can be the mechanism that enhances viral infection. Utilising all the details it shows that fine particulate matter was a significant supporter of COVID-19 cases in England.

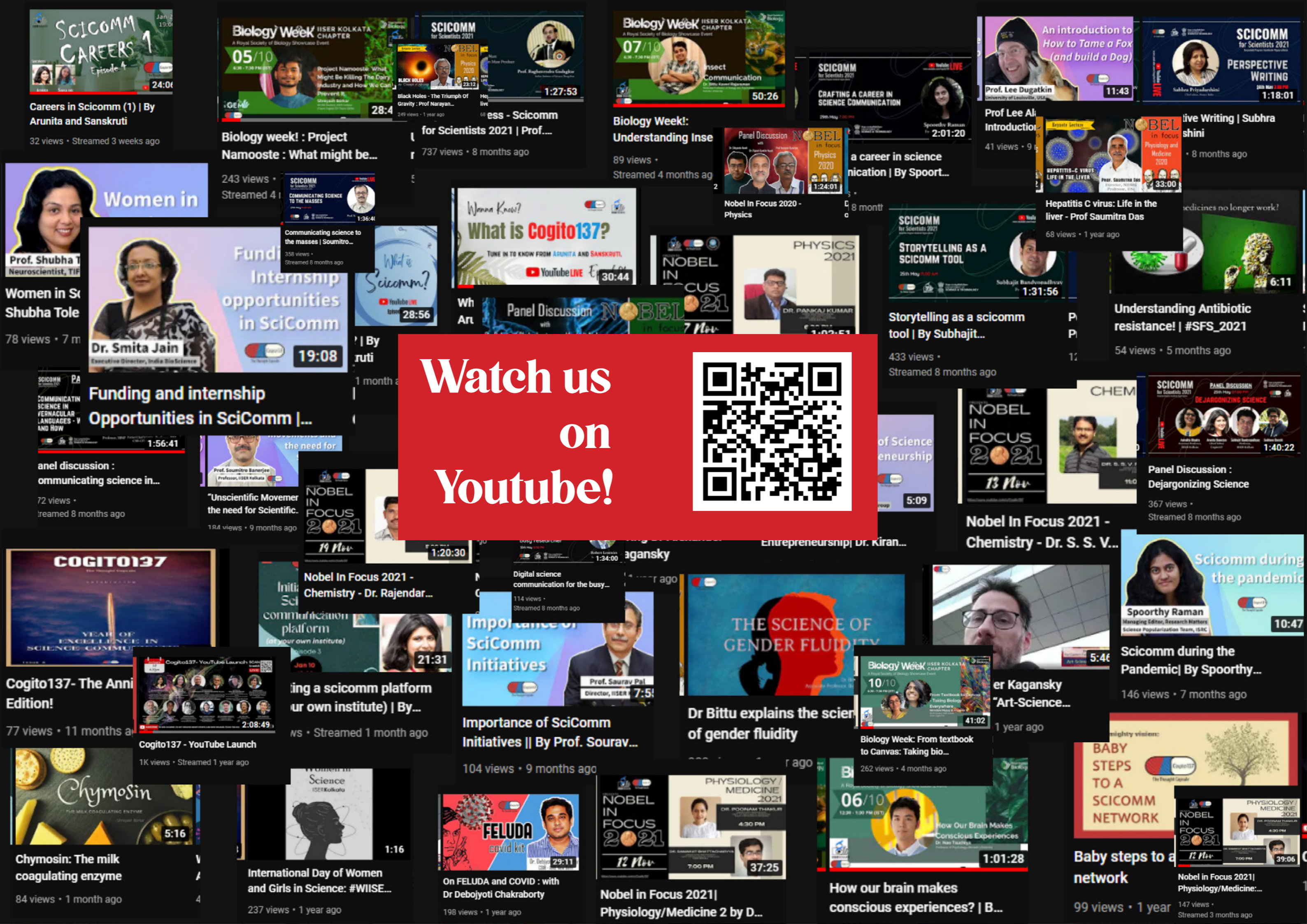


Credits: Cottonbro, Pexels

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Author Bio:

Shrushti S. Patil is a Space Microbiologist. She has a Bachelor's degree in Environmental Sciences and has pursued a Master's in Biodiversity. Nature has always piqued her curiosity. She also enjoys playing cricket.



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Sanskruti Biswal

Ladies, is coffee consumption affecting your fat distribution?

Obesity is a huge problem globally, related to many chronic diseases and higher mortality. This science article discusses a study published in The Journal of Nutrition that found an association between coffee consumption and fat distribution and percentage fat in adult women.



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We all have heard, “You are what you eat!” But have you ever wondered why? Food has many compounds that can potentially affect our organs, gut environment, and even mood! A collaborative study by researchers on adults in the United States has found a relation between high coffee consumption and lower adiposity. Adiposity is the accumulation of fat in specific areas such as the neck, breasts, and abdomen. The team that included biostatisticians, physicians and nutrition experts, found that higher coffee consumption was associated with lower fat in the chest and abdominal area, and lesser body fat percentage in women. According to WHO, obesity has increased three folds worldwide since the 1970s. Identification of compounds in coffee that can reduce harmful fat distribution might help promote a healthy diet.

Coffee lovers might be delighted that higher cups of coffee you drink, you might be cutting off body fat! But lead author Chao Cao from the Washington University School of Medicine cautions, “Our findings only observed that regular coffee drinkers have lower levels of fat. Further clinical trials must ascertain whether increased coffee consumption can, in fact, reduce fat”. Interestingly, the results also varied based on ethnicity/race! While for non-Hispanic white women and Hispanic women, the association between the amount of coffee consumed was observed, Hispanic black women didn’t show this trend. However, the overall evidence on the health benefits of coffee is strong in different populations.

This study stands out from those previously

done on obesity because it does not depend on BMI, which is not a good measure of body fat. A person with more muscle and bone mass will still have a higher BMI than a person whose weight is less but has more body fat which is harmful. This study used a body scan called DXA to measure the fat distribution or adiposity. Chao Cao explains that DXA is the gold standard for measuring body fat %, which uses X-rays to picture the inner body. It can show body composition based on the difference in density of body tissues. This study used self-reported data from the National Health and Nutrition Examination Survey (NHANES) programme for coffee consumption frequency. Many factors such as illness, food habits, smoking, and socio-demographic differences like age and sex can influence the adiposity of a person, which cannot be attributed to coffee consumption. These were taken into account from the NHANES database to remove the influence of external factors on the results.

In another study published in 2020, drinking hot tea was associated with lower fat. It would be interesting to extend this study to different countries and beverages and determine what it is in the contents that is beneficial to consumers. It is known that mainly caffeine in coffee leads to an increase in body temperature and greater metabolic rate. Since the results are observed in females but not males, it is speculated that caffeine might control sex steroid hormones responsible for differential distribution and amounts of adiposity. But, because decaffeinated coffee also showed the same effects, some compounds other than caffeine might be accountable, and further research is needed.

Coffee has a vast number of compounds that can influence the biology of an organism. While some studies link it with increased blood pressure and urinary bladder cancer, others have linked moderate coffee drinking with a reduction in diabetes and overall mortality. The scientific community is still debating on how beneficial coffee consumption can be. Importantly this study opens avenues to link compounds in coffee that might be influencing obesity and to understand how.

How to motivate people to improve their overall eating patterns by adding simple foods for

a healthy lifestyle? Chao Cao says, “Compared with specific nutrients, suggestions regarding single foods are easier for people to digest and adopt”. Adiposity in itself is not easily recognisable in everyday life and is unlikely to alter coffee habits. But, by understanding which compounds are responsible for the healthy distribution of fats, we are encouraging studies on finding such components from similar beverages.

Reference:

Chao Cao, Qinran Liu, Mohammad Abufaraj, Yunan Han, Tianlin Xu, Thomas Waldhoer, Shahrokh F Shariat, Shengxu Li, Lin Yang, Lee Smith, Regular Coffee Consumption Is Associated with Lower Regional Adiposity Measured by DXA among US Women, *The Journal of Nutrition*, Volume 150, Issue 7, July 2020, Pages 1909–1915, <https://doi.org/10.1093/jn/nxaa121>

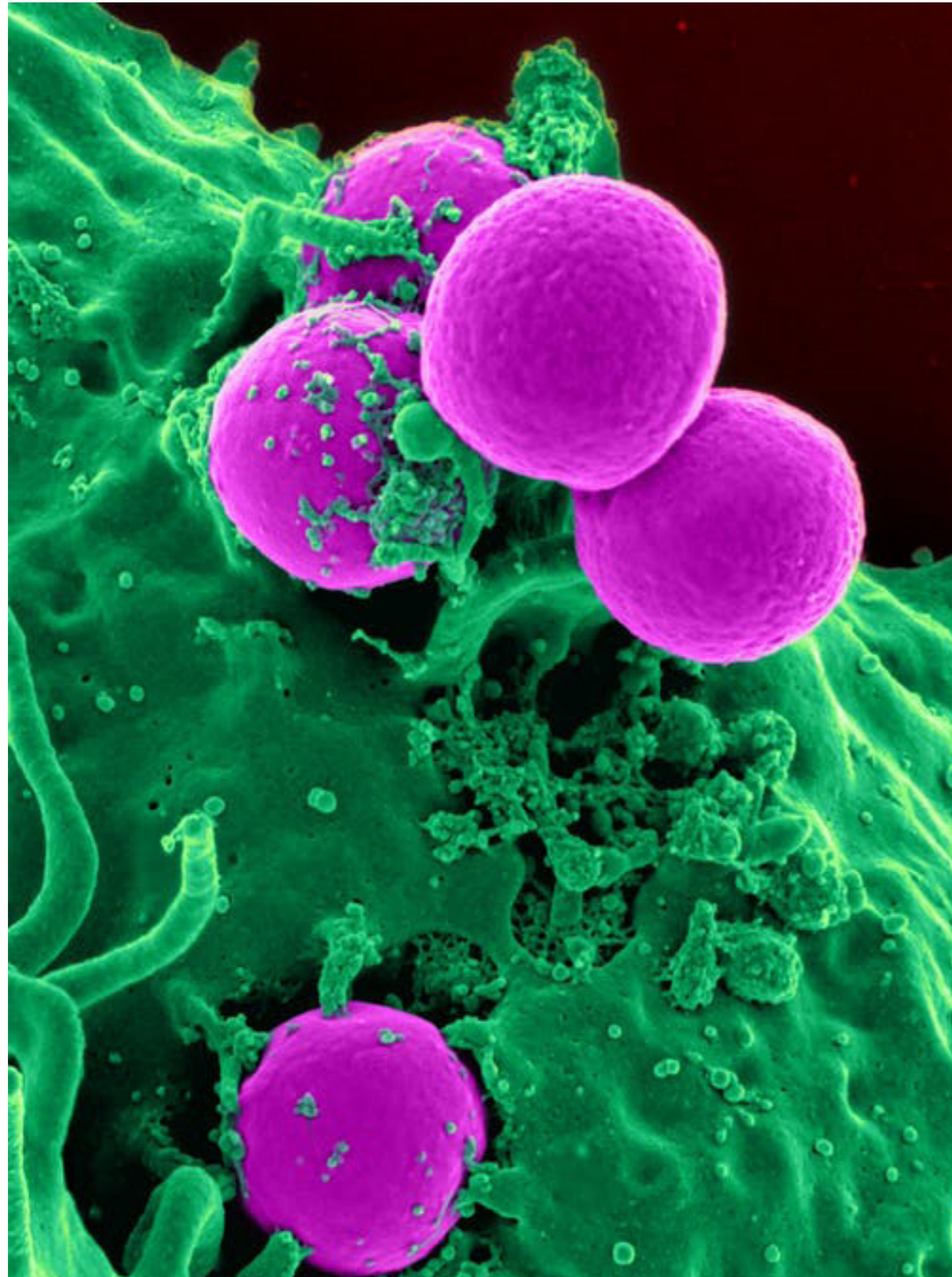


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Author’s Bio:

Sanskriti Biswal is a 2021 IISER Kolkata alumnus with an integrated BS-MS degree majoring in biological sciences. A student of Science and Health Communication at the University of Manchester, she wants to work full-time as a science communicator in future. She loves to dabble in anything sci-comm – talking about the field in Youtube videos, working as a science explainer in events, creating and editing content among other things. Indoors drives her crazy, and if not seen mindlessly scrolling through her phone, she can be found dancing, cooking, or on walks.

This article talks about a new method scientists have devised to detect bacterial contamination in food and water samples - using gold nanoparticles!



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Ashley

Scientists find a golden way to detect harmful bacteria

Harmful bacteria like Staphylococcus and Pseudomonas can grow inside our body and cause various diseases. The species of Pseudomonas called Pseudomonas aeruginosa is especially terrible because it can resist multiple drugs and cause long-term diseases. It can infect patients with burn injuries and weakened immune systems, thus earning the title - opportunistic pathogen. It has remained a leading cause of hospital-acquired infections. According to the CDC (Centre for Disease Control and Prevention), in 2017, Pseudomonas caused 32,600 infections in hospitalised patients and 2,700 deaths in the US. It became the sixth most frequently occurring pathogen and the second most common cause of ventilator-associated pneumonia. Pseudomonas mainly makes its way through contaminated objects, food, or water samples.

This grave scenario demands rapid diagnostic techniques to safeguard the patients and contain a possible hospital outbreak. However, existing methods of testing samples still rely on bacterial culturing, a method of growing bacteria on a

Credits: CDC, Unsplash



a culture medium that selectively promotes its growth. However, this method may take several days and give false results due to improper handling of the sample. Even though a few other modern techniques like Real-Time Polymerase chain reaction (RT-PCR) that detect RNA in the sample can provide accurate and sensitive results, they require expensive equipment and trained personnel - becoming unsuitable for cheaper diagnosis.

A group of researchers from Jiangnan University, China, recently discovered a simple, quick, and cheap method to detect these bacteria from contaminated samples. One can obtain results using a simple portable scanner in just under 20 minutes. This technique involves a gold nanoparticle-based immunochromatographic assay (ICA) strip that gives an easily readable colour change. However, samples containing few bacteria need to undergo bacterial enrichment using favourable growth media so that they can be detected. The enrichment process can take up to 8 hours, and a quick ICA strip test will give the result in



Credits: Mostera, Pexels

15-20 minutes. This is a faster detection method as compared to standard bacterial culturing that takes up to 2-3 days.

The detection method uses two things - antibodies or proteins that specifically bind on to the surface of Pseudomonas and gold nanoparticles, which have an intense red color. The nanoparticles are attached to these antibodies and mixed with a sample. When one applies the mixture to an ICA strip, it can give two kinds of signals. The strip will show a test signal and a control signal for a sample contaminated with Pseudomonas. In contrast, it will show only a control signal from a contamination-free sample. The control helps us know if the strip is working correctly or not, and the intensity of the test signal tells us the amount of contamination in the sample.

The strip proves advantageous because it does not give signals for other commonly found bacteria in water samples. Hence, the group of researchers succeeded in developing a technique

that produces an objective and easily interpretable output in a short time.

Across the globe, doctors have reported high rates of infections caused by drug-resistant Pseudomonas aeruginosa. The morbidity and mortality rates associated with this strain range from 18%-61%, making it a public health threat that needs immediate attention. The development of this ICA strip test technique is an efficient headstart to check for Pseudomonas contamination in food and water samples. Early detection of this bacteria can help prevent infection, spread, and save millions of lives. This study also lays a good foundation for future research to develop antibodies that are targeted explicitly against Pseudomonas.

References:

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2. Detection methods for Pseudomonas aeruginosa: history and future perspective (<https://pubs.rsc.org/en/content/articlehtml/2017/ra/c7ra09064a>)

Author Bio:

A voracious reader and science enthusiast, **Ashley** is forever trying (and failing) to balance her interests and manage 6 hours of sleep. She is currently pursuing a BS-MS degree from IISER TVM and looks forward to becoming a science journalist and a fiction writer in the future. (who says you can't be both?)

Anish Paul & Akshatha N. S.

A tangible tale of thermodynamics



Provided by Author

Have you ever wondered why ice melts when taken out of the refrigerator? How hot water eventually cools? Where does all the hotness and coldness go? The answer lies in thermodynamics, the mutual relation between energy (heat) with motion.

Thermodynamics is one of the many thrilling branches of physical sciences. It deals with the relations between heat and other forms of energy (such as mechanical, electrical, or chemical energy). Thus, on a large scale, thermodynamics deals with the relationships between all forms of energy. But contrary to the enormous complexities that come to mind when one comes across the term thermodynamics, we humans are benefitting largely using different ideas of thermodynamics in our daily life.

The term thermodynamics itself is complex terminology adding to its tangled tale. It comes from the Greek word “therme” means “heat”, and “dynamis” means “power”. So, thermodynamics can be represented as the relationship between heat and power- the science of doing some work using heat energy.

Though the textual concepts only teach us about the three laws involved and their limited application, the ‘dynamic’ nature of thermodynamics has a vast horizon of application. It talks about the energy of the entire universe and the fate of its transformation. Famous law “Energy can neither be created nor destroyed but can only be transformed from one form to another” explains the vastness of the concept.

Thermodynamics is a phenomenon that is intricately related to human life. The most prominent example of it is the use of electricity. The power plants convert the heat energy generated due to the combustion of fossil fuels into electricity which flows through the wires in our houses. With the click of a switch, the electricity is again converted into mechanical energy that makes the fan rotate or electrical energy that makes the bulb shine. Our vehicles do nothing but the same; they use the heat energy produced from the combustion of fossil fuels to produce mechanical energy further to give motion to the wheels. Refrigerators, air conditioners, coolers, etc., all absorb heat from a place to keep it cold and release the heat into some other area. Ther

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modynamics has implications in as simple as few kitchen tricks to as big as moving a rocket.

Beyond all these machines invented as a byproduct of developing science and technology, nature also has its share of using thermodynamics in its way. For example, the production of lightning is a phenomenon that uses thermodynamics in many forms. The clouds carrying water droplets are constantly in motion. This motion leads to the collision and rubbing of these droplets that give rise to friction, which produces a static charge. When it surpasses a limit, this charge is poured onto the earth in the form of lightning. When it comes across anything living or nonliving on the planet, this vast electric energy destroys it in seconds by producing colossal amount of heat.

Such examples are not rare in today’s world. Everywhere we look, we can see some influence of thermodynamics in it. But we fail to realize that because we use the concepts and information in ways or devices that we often take for granted in our daily lives. Thermodynamics teaches us to use energy in the most efficient way possible. From answering how to efficiently pump out water from the earth to how to cool a lemonade using ice, thermodynamics influences human life in a plethora of ways. But it does it in such a subtle, sometimes such an invisible way that it cannot be acknowledged.

Authors’ Bio:

Akshatha is a third-year graduate student at JSS Medical College, Mysuru, Karnataka. She is a budding biologist in Dr. Divya P. Kumar’s lab, exploring the pathogenesis of the nonalcoholic fatty liver disease, a lifestyle-driven condition. She’s a passionate dancer and a bibliophile with a life mantra - Be good, do good.

&

Anish Paul is a student of MSc Ecology at the Pondicherry University. He is interested in singing, writing and travelling and wants to study the ecology, behaviour and conservation of mammals to make a living

MEET THE TEAM!

Arunita Banerjee

Chief Editor

Arunita is a rebel and does not shy away from that identity. She joined IISER Kolkata in 2015 as an Integrated-PhD student. For the last five years, she has anchored, organised and coordinated various institute-level events and participated in other extra-curricular activities, alongside her coursework. In 2017, she decided to make science communication her primary objective and started freelancing at Research Matters, IndiaBioScience, Mongabay India, and Live Wire. She eventually co-founded Cogito137 and works as our current Chief Editor. She always has too much on her plate due to her varied interests in science, art, music, travel, animals, film direction, politics, and activism. You can find her running around the campus, interacting with the Director, faculty, students, and staff. On rare occasions, you would find her at her work-desk (which she calls a mess), discerning the behavioral patterns of free-ranging dogs at the Dog Lab.



Sanskruti Biswal

Managing Editor

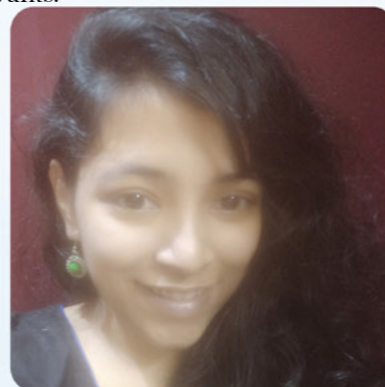
Sanskruti Biswal is an IISER Kolkata alumna who completed her integrated BS-MS degree majoring in biological sciences in 2021. Currently a student of Science and Health Communication at the University of Manchester in UK, Sanskruti wants to work full-time as a science communicator in future. With a keen interest in neuroscience, behaviour and ecology, she now wishes to combine her scientific training with her love for writing and talking about science, working in the field of science communication. She loves to dabble in anything sci-comm – talking about the field in Youtube videos, working as a science explainer in events, creating and editing written content for Cogito among other things. Indoors drives her crazy, and if not seen mindlessly scrolling through her phone, she can be found dancing, cooking, playing sports, or on walks.



Srujana Mohanty

Managing Editor

Srujana is currently a student of science in the 18MS batch of IISER Kolkata and was possibly a cat (we have reasons to believe so) in her previous life (if anything such exists). She has been with us since the beginning and has been our ever-efficient Managing Editor. A perpetually confused person, she wants to major in Chemistry and plans to research in the field of medicinal chemistry. Besides managing the team, she really enjoys reading, singing, and cooking. Above all, she likes traveling and being by herself. She just wants to be happy.



Shreyash Pramod Borkar

Chief Executive

Shreyash is a fourth-year undergraduate student at IISER Kolkata who joined the Cogito family in July 2020 as a highly silent and naive designer who has become the definition of multitasking with his involvement in design, publicity and management. He quickly transitioned from creating magazines in MS word to Adobe Indesign as a quick learner. He designed 05 issues and over 60 posters while heading the design team for a year before being promoted to be our first Chief Executive in July 2021. Simultaneously he has been managing our LinkedIn handle since Sep 2020 and has recently taken responsibility as the social media manager. Outside Cogito137, Shreyash finds peace in playing kho-kho, watching comedy series, sketching and has recently started creating animated videos as well. He is interested in synthetic biology and was part of Gold winning iGEM 2021 team of IISER Kolkata.



Debanuj Chatterjee

Editor

A science enthusiast, Debanuj finds himself studying optics and quantum mechanics after many rolls and knocks over the billiard board of life. He obtained a BS-MS degree in Physics from IISER Kolkata in 2017 and a PhD from the Paris-Saclay University in 2021. He recently joined our editorial team to cultivate his passion for science communication. He also takes fancy in playing the Indian bamboo flute (bansuri), writing short stories, creating mathematical art (visual and auditory), and playing football. As a physicist, he believes in conservation.



Alekhya

Editor

Alekhya is currently an editor in Cogito. She joined the team in the November of 2020 and dabbled her hands into various departments, including outreach, social media, etc. She tortures fishes for a living (not literally). She is a student of the 20IP batch.



Hrishika Dekate

Editor

A second-year undergraduate at IISER Kolkata, Hrishika is an ambivert who loves exploring new things, her most favourite leisure activity includes surfing the internet and binge watching series/anime. Besides being interested in biology she loves to travel, read and play sports.

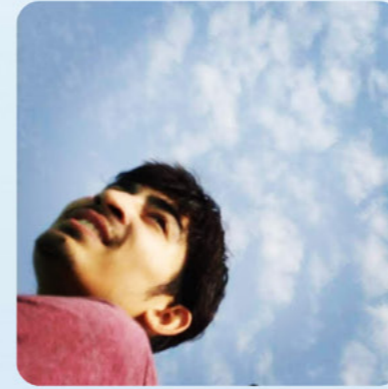




Tanishqa Ajay Chaubal

Editor

Tanishqa is a second year student who loves to write. Her other hobbies include drawing, painting and singing. Ever since she decided to start living a healthier lifestyle, she has become a total fitness freak. She loves working out at the gym and loves playing sports with her friends as well. She is also the one of the current office bearers of the Literary Club. In her free time, she loves to research unusual psychological diseases which is why her favourite movie genre is psychological thriller.



Abhishek Jangid

Video Editor

Abhishek is Cogito137's video editor, who is also an 18MS student at the institute. He joined our team in November 2020. Apart from editing interviews, talks, and seminars by scientists, he sometimes creates videos, teasers, and promos from scratch. Mostly working under extremely short deadlines, he feels that it has a different thrill. He usually leaves informal comic content in videos because he believes that something too formal fails to appeal to today's generation. He wishes that our editors come to terms with this point soon and stop calling his videos "too flashy sometimes".



Monish Majumdar

Editor

Monish is a first-year BS-MS student at IISER Kolkata. He is passionate about biology and quizzing.



Arunima Vadlamannati

Head Designer

Arunima is a final year BS-MS student at IISER Kolkata, who has a passion for both science and art. To get the best of both worlds she decided to join the two and that ended up with her landing in our design team. She's smart and funny (something only she agrees upon, :P), and not normal (this everyone agrees with). In her free time, you would find her painting, playing sports, reading books, or drinking an extensive amount of tea.



Aishwarya

Designer

Aishwarya is a 4th year BS-MS student at IISER kolkata. This is 24/7 entertainment we are talking about. Although her interests are in genetics and painting, her non-stop talks know no boundaries as such. She joined our design team in April 2021. She's a perfectionist and never attains it according to her. So, if you need some work done, give a deadline!! Tea and audiobooks calms her, so that's when you'll get a chance to talk XD.



Saptarshi Maji

Guest Editor

Saptarshi is currently a PhD student in the Department of Biological Sciences at IISER Kolkata. He was previously a BS-MS student at the institute. He works as our guest editor, editing Bengali articles. Apart from science, he has an interest in literature and art.



Achal Rajratna

Designer

Achal is a second year BS-MS student at IISER Kolkata. This is her interest in editing which leads her to this club. she is also interest in genetics as well as in sketching. she loves to try some new experiments in editing a poster. she also love reading book and writing some poetries for her own interest. she loves to see the world in different perspectives and analyzing conditons, like how everything can be right and wrong at the same time.



Prithiv Raj

Designer

Prithiv Raj is a PhD student at IISER Kolkata. He has joined cogito 137 team in Jan 2022. He is involved in designing.

Rahul Bordoloi

Website Head

Rahul is a socially awkward third-year Mathematics student at IISER Kolkata who joined the Cogito team in July 2020. He is our website manager and likes to mess around with computers and technology, though he claims that he is not good with them. He loves sharing his web-development experience with other people, and he believes that everyone in the world should know how to code. He runs a coding and designing club in the institute called Slashdot. It has collaborated with Cogito and plans to transform our website soon (keep an eye).



Rohit Verma

Website Manager

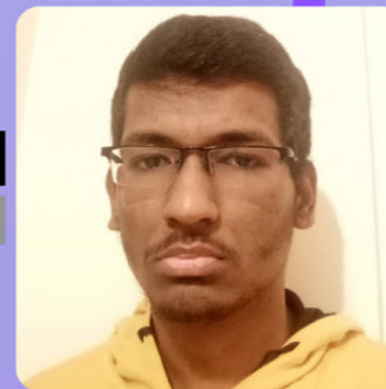
Rohit Verma is a BS-MS Student at IISER Kolkata (2020 batch). He joined Cogito137 during his first year of under-graduation and works here as a website manager. He has keen interest in physics, applied mathematics, and environmental and evolutionary science. He loves reading books, and playing classical guitar. Science, according to him, is among the most basic things necessary for human survival, and he wants everyone to have a glimpse of its beauty.



Sai Kishore N

Website Manager

Sai Kishore is currently a student pursuing a BS-MS degree (2020 batch) at IISER Kolkata. He joined the website managing team in April 2020.



Aniket Sabar

Youtube Manager

Aniket Sabar is a BS-MS Student at IISER Kolkata 20MS batch. He joined Cogito in his First year as the YouTube Manager. He is interested in learning more about the world of biological Sciences. He loves listening music, watching movies, playing keyboard and is always ready for some table tennis sessions. He is interested in travelling and visiting different places and is always willing to try out different activities. He edits videos and music for fun and wishes to learn more about them.

Isha Bhagwat

PR

Isha is a second-year undergraduate student at IISER Kolkata. Apart from her academic interests in Physics and Chemistry, she is fond of expressing herself through sketching, writing, and dance. She is the current PR Manager of Cogito137. She works very efficiently and is sometimes a life-saver, with her confidence levels always peaking. Recently, we collaborated with the Science Club of the Institute for a series of talks called Nobel in Focus, which she managed wonderfully. With her witty sense of humor, she also keeps amusing us with her creative posts on the Instagram handle.



Shireen Sultana

Publicity

Shireen is an 18MS student at IISER Kolkata who manages our Twitter handle since September 2020. She loves everything in biology, especially topics like developmental disorders and organ regeneration, and has been passionate about including people with disabilities in STEM. She believes that science communication engages a diverse population towards understanding the world and solving its problems. She also believes that for science to escape research labs and jargon-filled papers, we should make it more fun and accessible. She is a really kind person, and you should check her Twitter [@LifeisinDNA](https://twitter.com/LifeisinDNA) :)



Abhishek Sarkar

Publicity

Abhishek Sarkar is currently pursuing BS-MS from IISER Kolkata (20MS Batch). He is in the cogito team since August 2021. He is in the Publicity team, and he manages Instagram. He is highly enthusiastic about Astronomy and Cosmology. Apart from studies, he is very interested in football, reading comics, manga and musical performance.



Anybody can submit to us

- o Interviews
- o Biographies
- o Opinion pieces
- o News
- o Reviews
- o Perspectives
- o Snippets
- o Sci-toons - comics, memes,
infographics, etc
- o Artwork
- o Photographs



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