

DHVANI

A COMPILATION OF RESOURCES FOR
SCIENCE OUTREACH IN INDIA





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Content and compilation

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FOREWORD

The idea for **'Dhvani: A compilation of resources for science outreach in India'** emerged from a skill-building session for IndiaBioscience Outreach Grants (IOG) awardees in April 2023. My colleague Manjula and I had just added the finishing touches to the next round of the IOG call (the 4th consecutive year of the grant!), and we were getting ready to host the final skill-building session for the cohort of awardees. As we waited for the IOG community to join the virtual meeting room, I remember saying 'We have built an extensive set of resources for science outreach in India over 4 years, so much so that we could write a book on it!'. Not surprisingly, Manjula, who leads Community Building at IndiaBioscience, picked up on it. We ran the idea by the cohort of IOG awardees, and by the end of the skill-building session, it was decided that this book was going to happen!

My first science outreach engagement was as a PhD researcher in the United States. As part of a departmental initiative, I volunteered to host lab tours for a science outreach initiative for high-school girl students, aptly named 'Alice in Wonderland'. As part of the two-day event, I hosted several laboratory tours, which included mini-demonstrations of experimental work and laboratory safety. The two-day experience was engaging and fun, and left me with tremendous joy and fulfilment of being a part of a scientific endeavour that was bigger than the confines of my own research. Subsequently, in the final year of my PhD, I gave my first solo science outreach talk, as part of a long-running university program, 'Present your PhD thesis to a 12-year old', where I presented my PhD research to middle-school students at a local science museum. Very soon, I was seeking ways to be involved with science beyond the laboratory, including bridging it with my role as a scientist-parent, via judging school science fairs and student exhibits. While like most scientists, my science outreach interactions started with being a part of existing school and university programs, these experiences left me hugely inspired to start my own outreach program. Looking back, this was the seed that led to Talk To A Scientist (India), which I initiated on my return to India with co-founder Snehal Kadam. However, it was only while building Talk To A Scientist into a full-fledged program, did I understand the numerous aspects of science outreach, which includes building effective modes of engagement, evaluating learning and impact, and exploring funding sources. ***To sum it up, I realised that science outreach is much more than a compelling idea and consistent execution.***

With the aim to provide a framework to support outreach efforts led by scientists, IndiaBioscience started the IndiaBioscience Outreach Grants (IOG) in 2020. In its 4th year, IOG provides seed funding to scientists to initiate and lead outreach initiatives. While described as a grant, IOG has always endeavoured to be much more than a source of funding, providing mentorship and visibility to the community of awardees, as they build outreach programs. As the IOG program grows, IndiaBioscience recognises the need to further expand and support the community of scientists engaged in outreach in India. Towards this, we have developed **‘Dhvani: A compilation of resources for science outreach in India’**, for the wider science community. With a collection of original articles authored by public engagement professionals, science communicators, science journalists and scientists, **‘Dhvani’** provides a look into the vast realm of science outreach in India. The compendium includes perspectives related to the practice of science outreach, articles on sustainable science outreach models in India, interviews with scientists doing outreach in regional languages, skill-building guides to inform outreach efforts, and collections of ideas and funding resources to get started with. The perspective pieces take both, a collective and introspective view, by asking and answering critical questions on why our communities need effective science outreach, how science outreach can improve science itself, and what it means to build inclusive outreach programs. The featured models of science outreach include a decade-long ‘science cafe’ style engagement led by a working scientist, a science outreach collective focused on social enterprise, and an acclaimed regional language outreach program with multiple modes of engagement. The scientist interviews are a wonderful collection of personal stories, with insights into motivations to practise science outreach, and considerations and challenges of doing outreach in a diverse country as India.

For us at IndiaBioscience, **‘Dhvani’** was also an opportunity to take a closer look at the IndiaBioscience Outreach Grants (IOG), by revisiting the mission behind starting the IOG program and evaluating the impact of the program so far. The compendium also features initiatives led by select IOG awardees, from previously published content on the IndiaBioscience website. These inspiring IOG programs include in-person events, webinars, podcasts, infographics and books, and together, provide a closer look on what it takes to initiate and sustain outreach initiatives.

For professionals engaged in science outreach, the compendium also includes three skill-building guides, with practical tips on engaging with the mainstream media, evaluating the impact of outreach initiatives, and building a multilingual outreach project. In addition, the e-book includes a compilation of ideas, organisations, and funding sources relevant to starting and growing an outreach initiative.

Finally, **'Dhvani'** broadens the discourse on science outreach in India, by making the argument that science outreach is a tool for nation-building, for which we need to invest in formal education programs and career paths to build a trained cadre of professionals across modes, models, languages and levels of engagement.

Regardless of whether you have had experience with science outreach or want to get started, you have a wonderful outreach idea or are looking for one, or whether you are a science communicator, public engagement professional, student, scientist, medical doctor, educator, or science-curious citizen, **'Dhvani'** is a diverse collection of resources to inspire, ignite and inform your science outreach efforts.

Here's to building a better India!

Karishma S Kaushik

Executive Director, IndiaBioscience



THE IMPORTANCE OF
SCIENCE OUTREACH

From outreach to dialogue: Redefining science communication

SARAH HYDER IQBAL



To say that India is finally experiencing a wave of 'science communication' would be unfair to the pan-India civil society-led **People's Science Movements** that began after independence, the various government initiatives and institutions established to bridge the gap between science and society, and to the journalists and pioneering scientists of the 20th century who made science communication seem effortless and profoundly necessary. At best, this new wave is propelled by movements that, for a brief period, lost relevance in an economically liberalised, technologically advanced, and globally connected India, but are now resurging in a new sensibility.

In today's digital age, while scientific information may be readily available, the role of science communication is to transform this information into usable knowledge that empowers public to take evidence-based decisions about their well-being and that of their community and the planet.

Furthermore, in an increasingly interconnected world, science has global implications; it is now the world's safety net, an economic currency, and a diplomatic tool on the larger geopolitical stage. India must not only strengthen its capabilities in science and technology but also ensure that its contributions are well understood, recognised and adopted on a global scale.

Finding a common ground

While science and technology have evolved into an indispensable pillar of human progress and its applications are now deeply ingrained in our daily existence, the challenges ahead appear more complex than what can be solved with mere inventions and discoveries. Solving today's hydra-headed challenges requires innovative interdisciplinary approaches, which calls for scientists to recognise ideas outside of the traditional scientific realm and collaborate across sectors of society.

For instance, my recent interactions with sanitation workers underscored that scientific solutions cannot stand alone in addressing deep-seated issues like caste, poor governance, and urban planning. Likewise, grasping the intricacies of climate change and its effects on human and planetary health requires collaboration among various fields of science and society. To navigate these and other pressing problems of the 21st century, the scientific community must collaborate with society and find a common language and value system to urgently address them.

Nurturing interest and aptitude

This is why science communication and engagement with the public assume huge importance. As producers of knowledge with societal implications (and public funding), the scientific enterprise has a moral and ethical obligation to ensure that their research findings are not limited to the confines of academic conferences or scientific journals. Science, after all, is a public good. Scientists must ensure their research is accessible to the general public, which includes not just young children but also key decision makers at various levels and in different industries. This requires a combination of adaptable and creative communication skills and strategic thinking, which are not always emphasised during scientific training.

The current scientific education system primarily focuses on enhancing technical skills and expanding knowledge within hyper-specialised fields. While this is undeniably essential for scientific progress, it often overlooks the intersection between science, society, and culture and the significance of effective communication in helping the scientific enterprise grow, thrive, and be more impactful.

As a result, many scientists struggle to successfully convey their findings to non-experts, contributing to the growing disconnect between science and society.

Building a nurturing ecosystem

But to put the entire onus on scientists, arguing that their inability to communicate is the reason behind poor public understanding and engagement with science, would be grossly unfair and incorrect. As examples from science faring countries show, science communication requires resources, infrastructure, strong policy commitment, and diversity of approaches – basically, an enabling ecosystem that our country is currently lacking.

While the most recent Science, Technology, and Innovation Policy (STIP 2020) includes an entire chapter on Science Communication and Public Engagement for the first time, it is still in draft form and reads more like a wishlist than an intentional strategy. Similarly, the guidelines on Social Scientific Responsibility (SSR) is a positive step towards closing the science-society gap, but they lack a clear roadmap for scientists and institutions, leaving them unsure of how to act on them.

Furthermore, Indian scientists work in increasingly difficult research environments with insufficient resources and intense competition, making it difficult for them to think beyond their research. Unfortunately, their institutions have not developed mechanisms to foster and enable their interest or intent in science communication, as identified in a survey we conducted among biomedical researchers. Many scientists participate in science communication because they have a genuine interest and passion for sharing science and their research with people who are not their peers, and they recognise the value it has in their professional lives. These are, however, the exceptions rather than the rule.

Creating a diverse community

Though, scientists alone cannot, or rather should not, be expected to undertake this colossal task of taking science to non-expert audiences. Not only do they need infrastructure and resources to do this, but also strong allies.

Professional science communicators are one such ally and operate in various sectors, such as research institutions, funding agencies, NGOs, media, and streaming platforms, serving as science connectors and cultural translators who facilitates dialogue and mutual understanding between science and society while helping non-scientific audiences in navigating complex scientific information.

Listening to communicate and engage

It is important to acknowledge that science communication is a two-way street. Extensive research in this field has shown that simply 'disseminating' scientific information through 'outreach' is not enough; we must also actively 'listen to' and 'engage with' the public, addressing their questions, concerns and perspectives. This 'engagement' process is more beneficial than one-way lectures as it allows us to understand public's perception and knowledge of science (or a research field) which in turn helps us to tailor our communication style and content.

By fostering a dialogue with the public, we can also build trust and credibility, dispel misconceptions, creating an environment where scientific information is valued and understood, making people turn to science during crises. After all, as Angela Potochnik very rightly said, **“People aren't some empty jars that you can fill up with scientific information with whatever means we like”**. These interactions should not only provide the public with new scientific knowledge, but also offer scientists with new perspectives on their research, fostering a mutually beneficial relationship between science and the public.

Towards a new era

While the writings on the paper have not resulted in any concrete steps so far, the latest STIP 2020 policy draft and SSR guidelines signal a new dawn for science communication since the first mention of **the duty of every citizen to develop scientific temper, humanism, and the spirit of inquiry and reform** in the Indian constitution. The ecosystem of science communication in India must be built and strengthened through forward-thinking policies and programmes.

In order to address contemporary challenges and promote sustainable development, the scientific enterprise must shift from merely informing citizens to actively listening and collaborating with them. This century's 'People Science Movements' should emphasise a collaborative approach, where science and society work together to advocate for evidence-based decision-making and research that aligns with societal interests, needs and ambitions.

Sarah Hyder Iqbal

FAST India, Superheroes Against Superbugs

What outreach does for the scientist

SNEHAL KADAM



Before I share my experiences in science outreach, I want you to think about the moments in your childhood that sparked your imagination. The moments when you felt transported into wondrous realms, excited and inspired for the next adventure? While this sounds like a magical world, for me, it was when I explored the world of science! I remember feeling intrigued, particularly about life sciences, and various moments through my childhood have contributed to my continued fascination with that world.

Amidst the COVID-19 lockdowns in India, I, along with Karishma Kaushik, found the opportunity to take these 'magical' moments of inspiration and awe outside the confines of our laboratories into the lives of young minds through Talk To A Scientist (TTAS). Through this platform, we use live webinars and online-based engagement to showcase science and scientists to children in an interactive, engaging format to foster curiosity and appreciation for science, and build informed future citizens, leaders & decision-makers. Over the past 3 years, TTAS has hosted over 130 sessions, with 4000 participant engagements and more than 75 guest scientists.

However, we have shared many 'behind-the-scenes' aspects of running TTAS in other articles before. Today, I want to share how science outreach has personally contributed to my own professional development and well-being.

In the early days of TTAS, I quickly realised that sharing science with others amplified the joy of my own scientific pursuits. Through TTAS, we bring science to 'life', simplifying complex concepts and encouraging curiosity, all while incorporating fun every-day life anecdotes, cartoons, and movie references! Interacting with enthusiastic young minds had a way of reigniting my own passion for science, reminding me of the awe and wonder that initially drew me to this field.

Developing TTAS content every week, combined with the amazing questions the young minds asked, it made me a better communicator. It refined my ability to convey complex ideas in simple terms. When done right, science outreach has the potential to mould us into better scientists who can effectively communicate our work to diverse audiences.

Within a few weeks of TTAS, we realised the importance of expanding our horizons and bringing diverse science and scientists to the platform. We not only started conducting sessions on a wider range of topics beyond our expertise in microbiology, but also began hosting guest speakers, and this was a pivotal point in the journey of expanding TTAS. These guest speakers would bring in expertise on new topics, new perspectives and a new way for young minds to experience science. Along with the young minds, I end up learning something new every week. Science outreach propels scientists out of their comfort zones, exposing them to diverse fields, perspectives, and challenges.

As TTAS seasons went by, I saw gradual changes in our audience, especially our regular participants. The kind of questions they were asking, their abilities to link what they had learnt in a previous session to the current one and the lens of curiosity and scientific thinking through which they were now looking at the world; it is clear that science outreach really does empower young minds. By showcasing science as an exciting and accessible field, we create a pipeline of enthusiastic learners who become the scientists, leaders, and decision-makers of tomorrow. Witnessing the growth and development of these young individuals fueled my own commitment to TTAS even more.

Science outreach has the potential to act as a catalyst for change, encouraging scientists to step outside their laboratory and embrace the role of communicators and modern-day role models. Growing up, I didn't know any real scientists of the time. It was difficult to imagine myself becoming something I couldn't see. Today,

as we engage, communicate, and inspire, we collectively build a brighter future, one where science is accessible, inclusive, and driven by the diverse perspectives of our stakeholders (young minds, educators, guest speakers and more)! It gives me immense pride to contribute to a platform that aims to build these modern-day diverse role models in science for young minds.

For me, science outreach allowed me to develop skills beyond the confines of my research, including project management, leadership, and effective communication. Writing grant applications, supervising a team, and crafting engaging content has enhanced my abilities and expanded my horizons, all giving me skills that are applicable not only at TTAS, but in various aspects of my career path.

I have also been very fortunate that my science outreach efforts have received recognition at various fronts. Yet, three years later, the moments that give me the most happiness are when a parent, family member, teacher or young mind share how TTAS has impacted them. When a young mind reaches out to share how they enjoyed a session, or a parent sends a photo of their child engrossed in a hands-on activity, or when educators plan activities based on our free e-book—these moments fill me with immense pride and a sense of accomplishment. Every time I see these messages, I get goosebumps – it still seems a little unreal that I contributed to a young mind enjoying science!

TTAS has been my much-needed 'refresh' button in life. As I navigate the highs and lows of research and a PhD, I always feel excited and rejuvenated simply by looking forward to TTAS sessions. No matter how challenging my week may be, that one hour spent engaging with enthusiastic young minds uplifts me and really refreshes my mind. TTAS has become a space where I not only aim to share knowledge and inspire young minds but equally gain knowledge and find inspiration in return.

Overall, science outreach has been a transformative journey. It has the potential to make us better scientists and communicators, broaden our perspectives and make a positive impact on society. So, don't just ask what a scientist can do for outreach, but also what outreach can do for the scientist!

Snehal Kadam
University of Hull

Inclusive science outreach, what does it mean and why do we need it?

SAYANTAN DATTA



Science outreach and communication in India largely follows the deficit model. In this paradigm, people who are not involved in directly producing scientific knowledge – especially those who come from marginalised backgrounds – are seen as either lacking knowledge or interest. Science communicators are tasked with simplifying scientific knowledge and imparting it to the public.

In painting their audience as uninformed, naive and uninterested, the deficit model produces a hierarchy between the scientist, the science communicator, and the audience. Undoing this hierarchy is where the task of inclusive science outreach begins.

What is inclusive science outreach?

Inclusive science communication (and outreach) does not presume a deficit on the part of the public; instead, according to science communication researchers Katherine Canfield and Sunshine Menezes, inclusive science communication has the following three broad “traits”:

(a) Intentionality: Inclusive science communication (and outreach) must actively pay close attention to the audience, the definition of science, and how “marginalised identities are, and have been, represented and supported in engagement activities and communication products”.

(b) Reciprocity: Rather than seeing their audience as an inferior group that needs imparting of scientific knowledge, temper and values, science communicators must recognise their audience as bringing a ‘different’ set of expertise to the table. In doing so, science outreach and communication has the potential to become a bidirectional conversation rather than a one-way transmission of scientific knowledge.

(c) Reflexivity: Science communicators must continuously, critically and systematically evaluate their and their audience’s identities and experiences. This can help highlight inequities; once these inequities are identified, communicators can revise, adapt or reinvent their strategies to allay the inadvertent exclusionary tendencies in their practices.

Ensuring inclusive science outreach

Canfield and Menezes recognise – as I am sure all of us do – the difficulty in implementing the three traits mentioned above. That said, achieving inclusivity in science outreach and communication is neither impossible nor a single-step process. Instead, it requires deliberation, care and iterative practice.

Below, I will make a few suggestions that can be a starting point for science outreach and communication professionals to make their practice more inclusive. Readers must take note that this list intends to neither be exhaustive or acquire the form of a manifesto; instead, it intends to provide a framework that can be debated and developed towards inclusive science outreach in India.

Striving to work with a diverse audience and cater to their diverse needs:

As outreach and communication professionals, we recognise that we work with a diverse range of audience. Yet, in my experience, when we try to map our audience for a particular outreach event, we usually think about the age of our

audience or their relative expertise. Rarely do we take into account that not all our audience speaks and understands the same language, or that they might not relate to the same *Friends/Game of Thrones* references. Not all our audience can commute freely all the time, and not all of them can see, hear, speak or walk. Not all of them come from urban locations nor are they all upper-caste cisgender heterosexual men.

The first step towards making our work more inclusive is to critically reflect on who is able to access this work. Without expanding our understanding of how diverse our audience is, we will continue to exclude people from certain geographies, linguistic communities, genders and (dis)abilities.

Encouraging the leadership of people from marginalised backgrounds in science outreach and communication efforts: Having marginalised people lead science communication and outreach efforts will not only bring to the table perspectives that are otherwise ignored, but also encourage more people with similar lived experiences to participate in these efforts. Further, science communicators, outreach professionals, and funding bodies can make a strong statement of their commitment to diversity, equity and inclusion by having their marginalised colleagues in decision-making and administrative positions.

Painting a culturally relevant and honest picture of science and scientists: Science does not always happen in laboratories just as scientists are not always lab coat-wearing white men with ruffled hair. Science can happen in muddy marshes and dry deserts, and scientists come in all shapes and sizes and clothes and attires. (For example, in an Indian context, scientists can wear sarees, salwar-kameez, kurta-pyjamas, dhotis, and whatnot.) ***Therefore, to truly speak to the social and cultural experiences of its audience, science outreach and communication efforts must acknowledge and account for the cultural contexts in which science and scientists work, and strive for a diverse representation of science and scientists in science outreach and communication outputs.***

In addition, science outreach and communication professionals must also be careful about the picture they paint of science itself. For instance, in attempting to talk about the benefits of a scientific discovery, are we inadvertently conveying to our audience that science is flawless? Are we adequately discussing the troubled history of science? (For instance, science has progressed greatly during wars, and scientific discoveries, like the atom bomb, have been used as weapons of mass destruction.) Are we telling our audience that scientists often disagree with each other, and disagreement is one of key ways in which science progresses? Are we

telling the audience that science and scientists can often be casteist, homophobic, transphobic, sexist and ableist? Importantly, are we telling our audience what scientists do, rather than just telling them the key findings of a study?

Ignoring the questions above can often lead us to paint a hyper-glorified picture of science. While it can indeed make our audience aspire for science, as sociologist Gita Chadha had remarked, it can also paint a very inaccessible picture of science.

Encouraging transdisciplinary engagement: Many feel that science is beyond their reach because most people have been told that only “good students” take science. Ergo, everyone who studies other disciplines are not “good students”. Even within the sciences, there is a hierarchy of disciplines, and this hierarchy is gendered. The “hard” sciences – physics, chemistry, mathematics and computer science – are more coveted and often have a higher representation of men, while the “soft” sciences – biology and psychology, for instance – are seen as less rigorous and have a higher representation of women (see this and this).

Science communicators must actively contradict these beliefs by invoking transdisciplinary perspectives in their work. This is because these distinctions are simply outdated in contemporary science practice (in June 2023, I reported on the work of a physicist who mathematically models how people aggregate and disaggregate in online hate communities). Further, a growing number of scholars in the humanities and social sciences – for instance, in computational social sciences – are making crucial discoveries about the progress of scientific knowledge. These are exciting developments that science outreach professionals and communicators should strive to convey to their audience, rather than talk about science in silos.

Reciprocal engagement with the audience: Our audience is not a sink where we, science communicators, must deposit scientific knowledge. Instead, they are people who have the right to know – and question – what is happening behind the iron gates and tall walls of buildings built using public money. Thus, science communicators should aim to encourage reciprocal conversations with their audience. This will help increase the public accountability of science.

(Poor public accountability of science has been posited as one cause of decreasing public trust in science.)

Not invalidating our audience’s experiences and ways of knowing: Science outreach and communication does not always need to be combative. While it is

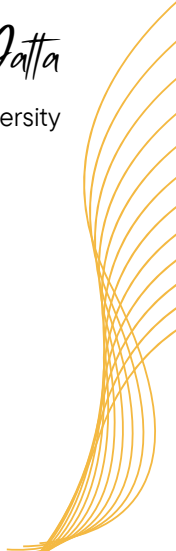
true that misinformation is on the rise, it is also true that at least in the context of India, a majority of the public trusts science and scientists.

That said, science is not the only way of making sense of the world; people employ different knowledge systems to make sense of their diverse experiences of the world. Science outreach and communication professionals must take into account these diverse ways of knowing. Invalidating the same often alienates our audience and leads to a decline in their engagement with science outreach and communication efforts.

Actively addressing social issues: For too long now scientists, science communicators and outreach professionals have portrayed science as a discipline and practise that is free of social and cultural influences. Nothing could be more untrue; scientific discoveries impact society as social structures impact science. Thus, the need of the hour is for science communicators to actively find avenues that lay bare the complex interactions between science and society. In fact, such an attempt might also enable science to become a tool for social justice. For instance, consider how Dr. BR Ambedkar called casteism an unscientific practice. Similarly, science communication in the past has been mobilised against exploitative superstition, homophobia and transphobia, and sexist societal beliefs.

In this article, I have attempted to chart ways in which science outreach and communication can be made more accessible and inclusive. I strongly believe that well-informed, collaborative and socially conscious science outreach holds the potential to undo oppressive systems and emancipate marginalised groups. Whether the science outreach ecosystem in India will help materialise this potential is an open question – one whose answer I hope is a resounding positive.

Sayantana Datta
Krea University



For learning never stops

SACHIN RAJAGOPALAN



As an individual who grew up in a family of academicians, I was always inclined towards academics. As an academician and a science enthusiast, I always found it interesting to make science appealing to audiences who are unaware about the subject. It was amazing that I got an opportunity to work with like-minded individuals to popularise biology as a science among school students and share my experience of exploring teaching and learning strategies with enthusiastic teachers who wish to transform their classrooms into a new hub of effective learning experiences, and also develop some open educational resources to spread awareness about antimicrobial resistance.

During these outreach activities, I learned a lot as an individual, and it also impacted the scientist in me to look at biology in a different light, which textbooks and classrooms may fail to impart. I am happy to share the insights I gained in the process.

a) Strengthening your communication skills and diversifying your skill sets:

I strongly believe that **“Science that is not communicated well is as good as science not done”**. One may have come up with a breakthrough in science but if

that is not communicated effectively, the world may fail to recognise it. I always felt if Gregor Mendel had made efforts to promote his work and had propagated his work in the form of Mendelian laws and not merely as a set of data, he would have been recognised way early for his brilliant contribution to the field of biology.

Under the aegis of the IndiaBioscience Outreach Grants and the able leadership of Mayuri Rege, we at Ramnarain Ruia Autonomous College started Aamchi Prayogshala, an initiative which aims to take the biology lab to the remote areas of Thane district in Mumbai so that even school students from economically weaker sections or with physical disabilities get a chance to work on simple biology experiments and get to experience science. During these sessions, we had to communicate with the students in regional languages like Marathi or Hindi, which was also their medium of instruction at school. That is when I realised the gap in propagating the advances in science and technology to the common masses. We were unaware of what are the terms used for concepts like incident/reflected/refracted ray, acids/bases, adulteration, etc. So, the work started with understanding the commonly used terminologies in these regional languages to make the students feel comfortable and help them understand what we were trying to tell them. We even planned how anecdotes and stories can be used as a medium to communicate science effectively. It gave the entire team an opportunity to not just strengthen our communication skills but also diversify the skill sets that we had. More importantly, it taught us the value of perseverance and patience, too.

b) Exhausted of ideas? Learn to question everything:

Working with school students always charges you up. The way the students think at that age is very different, and they never fail to surprise you. They come up with the most interesting questions. Questions that, even after working in your area of expertise for a long period of time, would have never popped up in your mind.

Once, when we were demonstrating chalk chromatography with black ink, a student in 7th grade innocently asked, *“What if I use charcoal paste instead of ink, will the colours still separate?”* The only answer I had then was, *“Let us try and see!”* They also wanted to mix up the water colours they had and then use that as a sample to see if the colours get separated on chalk. Their excitement and enthusiasm motivated us to give more than what was planned for the session.

I believed in questioning, but with this experience, I realised questioning can lead to ideas which can make way for the emergence of new knowledge.

c) Low threshold, high ceiling:

We have millions of students who pursue higher education in science. We have thousands of colleges where undergraduate and postgraduate courses are offered. But we know that infrastructure is where most of our academic institutes face a glitch. Our students are very strong in theoretical understanding of the concepts but may lack the practical experience.

But when I got trained and started working as a master trainer with the Maharashtra State-Development of Educators and Enhancement in Delivery (MS-DEED) program, organised by the Maharashtra State Faculty Development Academy & IISER Pune, I learnt from Asim Auti, Manawa Diwekar, and Neeraja Dashputre that we can transform our regular lab experiments to low threshold-high ceiling experiments such that even without high-end instruments or expensive chemicals we can still expose students to challenging problems and give them a push to think beyond the box.

While conducting sessions with the MS-DEED team in different parts of Maharashtra, I got an opportunity to interact with teachers from remote regions where infrastructure is minuscule, student enrolment is on a decline, and attendance is also poor. These teachers were enthusiastic and wanted to learn strategies to increase the footfall in their classrooms, create the interest among the students to learn science, and change their rather silent and dull classrooms to vibrant hubs of learning.

I was surprised to see how they, with their limited resources, still managed to make a concept appealing and easier to understand for the students. This was one of the big lessons I learnt. You may have well-equipped labs and lucrative grants, but still, it falls short. I learnt to work out ways with the available resources and manage to do good and impactful science. I started valuing the resources I always had when I saw how people strived to make the best of what they had.

d) Propagate science to the masses:

This year, I got an opportunity to develop an open educational course titled, 'Let's Fight AMR- Awareness about Antimicrobial Resistance' (AMR) under the aegis of Open Education for Better World (OE4BW), an initiative by UNESCO so that people around the globe can learn free of cost.

This course was an initiative to spread awareness about antimicrobial resistance, which is considered a global threat as this can give rise to yet another pandemic. This course was open to people from all walks of life, irrespective of their

background and age. It was indeed a challenge for me to explain the concept lucidly so that even a person from a commerce or arts background could understand the issue. I was surprised that people from non-science backgrounds were very active throughout the course and keen to know more. They had super interesting questions to ask about the microbiome, and how our lifestyle impacts the emergence of AMR. They also communicated about the issue to their family and friends as a cascade activity of the course so that the message reaches a wider audience about what AMR is and how to fight it.

This made it clear for me that we as a community need to take efforts and go beyond our comfort zone to communicate science to a wider audience. These small steps can help inspire the next generation to pursue science as a career. You may be the one to ignite the passion for the subject which an individual probably never even considered as a possible domain for them. This is just the start. I am looking forward to more such experiences which will make me a better scientist and more importantly, a better person.

Sachin Rajagopalan

Ramnarain Ruia Autonomous College

A scientist's journey of navigating science outreach

SAMATHA MATHEW



Jigyasa (uncountable noun): Curiosity, a desire to know about things.

The very first time someone asked me what outreach means to me as a PhD scholar was for a [blog post by Science Bagels](#), a scicomm venture by Poorti Kathpalia, Scicommer Project Scientist at CSIR-IGIB. To paraphrase what is now published as a part of the Science Bagels blog is that, I tend to fall in love with the science we do every day anew, every time I am part of an outreach event.

They say no man is an island, but researchers and scientists can many a time give you a run for your money on this. Rarely do we realise when we slowly become part of the metaphorical academic ivory tower and inadvertently get distant from the common 'human'. While it is important that the products of the scientific ventures reach the citizens of the country who fund most of the research through taxes, the transfer of information generated by scientists and academics have mostly followed a trickle-down model that is heavily biased and unstructured. But even while most scientists think outreach is a one-way street, it really is not — it is a clear transaction as any other.

Seeing your own science in a new light

Ask an Indian about the science in their country, and they would most predictably

bring up the Indian Space Research Organisation (ISRO) — its rocket launches celebrated as much as IPL cricket matches or the release of a blockbuster movie. The pandemic has been a mixed bag where science communication is concerned — while the greater population have finally picked up a few names of scientists who are not affiliated with space research organisations, the extent of misinformation, disinformation, and blatant conspiracy theories have skyrocketed, aided by the ever-expanding consumers of social media. I, of course, propound that it definitely should be a scientist's business on how their country sees science. And what any scientist can do is find a suitable outlet, big or small, one-time or periodic, simple or sophisticated, solo or collaborative, to distil their science into something palatable for the general public. It is not easy, and is quite an art.

As the word says, outreach is meant to connect a scientist to society, and yet, it tends to only connect to our immediate circle. Most research institutions are placed among privileged communities, in every part of the world. Outreach must help create a warp in that regular privileged social fabric of scientists and connect with students from less privileged backgrounds. But then of course there are many scientists who come from less privileged backgrounds. They take an active interest in connecting back to their communities, almost acting like a bridge, not only among communities, but from present to a more equitable future. I have been fortunate to work with outreach coordinators who seem to realise this gap in our regular outreach activities. The schools catering to privileged communities tend to know their way to come find us anyway, while the schools in rural areas are limited by the lack of networks, language, and logistics, among other privileges. And then there is the outreach itself, which pushes the scicommers outside their comfort zones — we need to learn to convey our science in regional languages, something I must admit I have found myself struggling with. So, apart from knowing your science so well that you can simplify it to explain it to a restless school goer with an attention span of a few seconds, you also learn to think in abstract terms to connect your science to local analogies.

Learning humility as a scientist: Science is for all

Those of us who have been part of science festivals such as the India International Science Festival (IISF), stretched across a few days but thronged by thousands of students and the general public, know how they shatter the monotony of the ivory tower. Scientists tend to pretend that most of society is uninterested in the specifics of the science they do. But such events easily show that you can always connect to society as much as any other media personality, without any of the glam — your science is the glam element! I still recollect the DIY DNA isolation stall at IISF 2016 being such a huge hit.

We had done (actually supervised) hundreds of DNA isolations. The kids and even adults enthusiastically performed DNA isolation from their own saliva. The glee on their faces on finally seeing the thread-like DNA (often quoted as such in textbooks) is unforgettable many years later.

At the end of my PhD, an eight-year-old's mother had written to me, having come across an outreach session on [YouTube, hosted by Talk to a Scientist](#). I ended up hosting this wonderful, curious and brilliant kid for a day at CSIR-IGIB's zebrafish lab, making me feel like I was conscripting him into zebrafish research. He also asked me some jaw-dropping questions quite unexpectedly, making his mother beam with pride. It was really humbling for someone like me who had spent years researching the topic, and having addressed many other younger kids before.

Unapologetic self-interest: Finding future torchbearers of science

From the point-of-view of pure self-interest, science outreach is also a future investment portfolio with a distinct ROI. This happens at many scales. At every outreach session, we hope we have managed to ignite the minds of our next genius and hypnotically attract them to the field of science and research. I remember a much firsthand account of this from a scientist when she went down memory lane, recollecting setting up the young, new institute. She said it wasn't easy attracting people to do the kind of novel science they envisioned to do at this new institute. So, they opened the doors of the institute and invited schools and colleges for visits, hoping at least some of them would come back and build the institute from the ground up, which of course, has materialised through the years since.

As it happens, I have met quite a number of scientists who believe outreach isn't their cup of tea, not for the lack of knack, but for the lack of interest. Of course, it is a personal choice, and outreach is as tedious as any other work — to spend time simplifying science, reaching out to folks outside your network and like many other activities in academia, most outreach is done without the expectation of any monetary return. But in my personal experience, one cannot do outreach solely for a non-research crowd. You simply have no way to laser-focus that way. I have had an Indian researcher working in another country write to me after coming across the outreach session on [YouTube, hosted by Talk to a Scientist](#). When a peer wrote to me about scientific queries and mentioned the same outreach video, it made my conviction that outreach for a scientist is important for many reasons much more concrete.

Finding our space in society

What scientists do not appreciate is how inaccessible and exclusionary our practices of scientific publishing, academic conferences, and close-knit networks can be. **Social media is for scientists drilling a hole through this wall, letting the light in slowly.** This was another semi-outreach event I did with Karishma Kaushik and Snehal Kadam, brilliant science communicators in their own rights, where we emphasised on the importance of scientists taking up social media, and outlined the benefits to our own scientific careers and networking. Most of us who are active on social media have realised it does bring in the unintended audience, sometimes even hostile, but other times simply delighted at the science and that they are learning things by 'just scrolling through the internet', not to mention the thrill of interacting with real-life scientists. As it is, many of us have experienced our tweets finding their way into news articles, propelling us into a visibility we could not have foreseen. As mentioned earlier, this, of course, comes with its own dose of vitriol. Where having a scientific opinion seems like a political agenda, one can get attacked for simple science outreach as well. And hence, the point of many fellow scientists does ring true — not everyone is cut out for science outreach, especially through current popular media on the world wide web where trolls shower abuse on you, and anonymous accounts are adept at the flying monkey phenomenon.

One would think it is much easier to stick to writing columns in newspapers, write your own books, and so on. But then again, each of these activities requires a different sort of commitment, not to mention having to work with folks who do not follow your kind of work style. From a n=1 experience of writing a children's science book published this year (July 2023) with World Wildlife Fund-India, what opened my eyes most was how the academic style of having hard deadlines that strangle creativity does not quite make much sense to people in other creative pursuits. Such interactions would mold the scientists to think about the way they approach their profession and pick up tricks to be more creative, to know to pause and reflect, when and where it is needed.

The bottom line really is that outreach forces a scientist to break out of the widespread holier than thou attitude, while very obviously feeling truly in service to the society, as many of us claim was the driving force while starting off a scientific or academic career. And it also circles back to curiosity — what better way is there for scientists to keep their curiosity alive than to indulge bright, curious minds?

Samatha Mathew

CSIR - National Institute for Interdisciplinary Science and Technology



FEATURED OUTREACH
MODELS IN INDIA

Flight of the sparrows

Featuring H.S. Sudhira from Gubbi Labs

LEKHA BANDOPADHYAY



Our stay on this billion-year-old planet offers us complimentary access to its gorgeous evolutionary show of flora and fauna. But we are so busy rushing down that rabbit hole finishing our life course, we have little time to appreciate that privilege. We are oblivious to the whereabouts of frogs in our backyard or sparrows, our chirpy winged neighbour. The eventual ignorance about our earthen habitat reflects in our insular urban planning with disastrous outcomes. Gubbi Labs, a social enterprise in Karnataka aims to intervene there and focus on building conscious citizens, sustainable cities, and ecosystems.

In search of independence

H.S. Sudhira, Director of Gubbi Labs, a PhD in Urban Planning and Governance worked for a while as a land use and transportation specialist at the Karnataka State Government and later as a Faculty at Indian Institute for Human Settlements, Bengaluru. Through this tour de offices, he discovered that he needs to carve out an independent organisation to do the kind of trans-disciplinary work he was planning “*with the necessary freedom in thought, innovation, and collaboration*”. as Sudhira words.

Thus originated Gubbi Labs, a research collective also doing consultancy, training, and science communication. Set up as a for-profit, limited liability

partnership company in 2010, it operates from and is named after Sudhira's hometown, Gubbi, named historically after house sparrows (called gubbi in Kannada). Sudhira notes, *“In 2020, a non-profit entity called Gubbi Labs Research Foundation has also been set up. Under the foundation, the research, courses, and science communication verticals operate. Under the company, research-based consulting, advisory, and practice continue”*.

As a transdisciplinary entity, Gubbi Labs aims to bridge theory and practice. They use statistical and spatial analysis tools like GIS and remote sensing to power their research in studying cities and ecosystems which spans from “Developing models to simulate how cities grow to works on e-governance or technographical analysis or studying faunas from different taxa like frogs, diatoms, leeches”. says Sudhira.

Making greener cities

Gubbi Labs generates most of the revenues from consulting assignments in urban planning and policy-making. Sudhira says, ***“We have been part of expert committees that have been set up as an outcome of the rulings of the National Green Tribunal and thus contributing to studies or reports that have been submitted to courts, hopefully helping the courts to make decisions”***.



Glimpses from the Bisle Frog Watch 2023 | Photo credit: Vineeth Kumar

They have worked with the Karnataka State Road Transport Corporation to make a research-based plan for introducing a bus-based public transport system in tier-II cities of Karnataka like Tumkur and Hassan which earlier relied heavily on motorcycles and auto-rickshaws. Their other notable contributions to greener transport are creating a network map of bicycle-friendly streets in Jayanagar, Bengaluru, and building the software for ‘Namma cycle’, a community bicycle-sharing system for short commuting needs by paying a

charge. Sudhira adds, ***“These interventions in public transport eventually got scaled up across the country in the last 13 years and have impacted more than 25 lakh people directly”.***

Growing a community of citizen scientists

A long term initiative by Gubbi Labs is Project Ashoka through which they estimate the biodiversity in poorly studied non-protected areas and simultaneously grow a community of citizen scientists rekindling their interest in nature. Thus every monsoon since 2012, Gubbi Labs arranges Bisle Frog Watch in Bisle, Western Ghats. This three-day citizen science initiative attracts students, researchers, and nature enthusiasts who are trained to study and identify amphibians, and the findings are openly shared.

Sudhira says. *“The trained citizen scientists went on to discover three new species of frogs”.* One of them is the Honnametti bush frog discovered at the Biligiri Rangaswamy wildlife sanctuary. The other two are the laterite narrow-mouthed frog inhabiting the laterite rocks of the Udupi region and the Karaavali skittering frog from the Karaavali coastal region of Karnataka. The latter two are potentially endangered being the inhabitants of nonprotected regions.



Team posing at the Bisle Frog Watch 2023 | Photo credit: Vineeth Kumar

The other initiatives under Project Ashoka are Open Tree Map – Bengaluru which was launched in 2017 to map all the trees in Bengaluru, Bird Monitoring Program – Bengaluru conducted from 2018 to 2021 around several wooded areas and wetlands of Bengaluru, and Long-term Vegetation Monitoring Project at Fergusson College, Pune to understand changes in the trees and

bushes in the campus over time. Gubbi Labs has published guidebooks featuring frogs and toads, Indian diatoms, ants, and mantids and maintains a [shared Google map](#) for reporting the sightings of their namesake sparrows by the people of Bengaluru. They also keep on doing interesting [workshops and courses](#) to give citizens the opportunity to learn the tools and methods to be independent researchers. Sudhira notes, *“Almost 400 participants cumulatively have benefitted from our courses directly”*.

Sharing knowledge as the common good

[Research Matters](#), a science news portal in six regional languages besides English is currently part of the science communication vertical of Gubbi Labs. Sudhira says, *“Initially, ‘Research Media Services’, a division under Gubbi Labs operated the Science Media Center at [Indian Institute of Science](#), Bengaluru from 2014 to 2018. Since we started covering stories from other institutions in India, we needed a larger umbrella to post these stories, and hence ‘Research Matters’ was born in 2016”*.

As there is no governmental or private funding yet for such independent initiatives in science outreach in India, the communication vertical of Gubbi Labs run by a small team and a pool of freelance science writers across the country is totally limited by revenues generated by their consulting assignments.

[Harini Nagendra](#), Professor, and Lead, Centre for Climate Change and Sustainability, [Azim Premji University](#) comments, *“New advancements in science and technology are reshaping our world with increasing speed. Organisations like Gubbi labs play a very important role here as interpreters and educators, especially so in Indian cities, where the degradation of ecology and environment is visible all around, and where citizen awareness and participation is essential to motivate administrators and policy makers to act. But these endeavours also require significant investment, which is currently lacking in the Indian context”*.

Gubbi Labs is indeed trying to fly on the strength of its small wings, but showcases the sheer limitation of doing science outreach in India. Sudhira sums up, *“Around twenty-five thousand high-quality research articles are published each year from India, but only a few get communicated to the people of the country. Thus annually we manage to publish close to two fifty stories only”*.



Lekha Bandopadhyay

Freelance Science Writer

Smart folks listen to smart news

Featuring Kollegala Sharma from Janasuddi
LEKHA BANDOPADHYAY



Hailing from Kollegal, a remote town in Karnataka in the late 70s, science communicator Kollegala Sharma (A.S. Kalyana Venkata Subramanya Sharma) remembers walking for miles in Bengaluru as a young boy with his father looking for old issues of Scientific American. Sharma says, *“I was fortunate as my father taught me English and bought magazines with whatever meager income he had”* as otherwise he would have to starve if searching for such resources in Kannada.

Lingual bottleneck

The scenario hasn't changed much after decades when apparently information is at our fingertips. Most Indians read science up to the tenth standard and then only a small fraction pursue studies in the science stream. The rest gradually drift farther and farther away from the shore of the happening world of science. Assuming it to be too technical, the tag of 'science' itself puts people off, and they are especially least bothered when communication is in English.

English is the working language of scientists worldwide. Coincidentally one of the official languages of India is English as well, but surveys show that 90% of Indians speaking different vernaculars are not comfortable interacting in English. Probing analyses reveal that the reality is more complicated by factors like location, caste, gender, wealth, and so on. Conveniently, however, English is the major language

of science communication in India causing a lingual bottleneck for effective outreach.

A serendipitous podcast

As a mentor in an education intervention project run by Swamy Vivekananda Youth Movement, Saragur, Sharma was counselling a group of teachers from government schools in Karnataka. He noticed that they were concerned about the general apathy of students toward science textbooks but themselves were reluctant to avail resources in English to advance their classroom teaching. So Sharma put together a 10 min demo audio digest of recent research in Kannada and shared it in their WhatsApp group.

He says, *“They relished it and suggested producing it regularly. That’s how Janasuddi meaning smart news or knowledge began in 2017”*. It became public after some time and is currently reaching remote corners of Karnataka. Now a weekly 30 min podcast, Janasuddi is still distributed through WhatsApp for the convenience of many listeners, especially teachers. The episodes are also available on YouTube (1 to 100) and Spotify. (100 onwards).



A class listening to Janasuddi on the eve of Annular Solar Eclipse on December 24, 2019

Photo credit: Kollegala Sharma

Spreading wings

As a 2020 finalist in the science engagement category of the Falling Walls Science Summit in Berlin, Sharma mentioned **“Not only language but Janasuddi is also breaking the walls of geography and social hierarchy”**. Incidentally, it is also the first science podcast in India as he mentioned.

Unlike texts, podcasts can reach people busy or idle under different circumstances effortlessly. Thus, while Janasuddi is a way for many teachers to remain updated about developments in science, it is also shared with or played to students in classrooms to know about science casually, some listeners enjoy it while eating breakfast, doing chores in the house or travelling.

Sharma adds humorously *“The best compliment Janasuddi received was when a fan wrote that hearing it relieves him of tension while waiting at the infamous Silk Board Junction in Karnataka for the red light to turn green”*.

Through more than 20 community radio stations, Janasuddi presented a play recently on the importance of Darwin and evolution which was removed from class 10 science textbooks by NCERT this year, raising objections. Sharma says *“Now around ten community radios are broadcasting Janasuddi regularly”*. They are from Saragur (Janadhwani), Mysore (Janadhwani, Radiomanasa, JSS Radio) Puttur (Panchajanya), Manipal (Radio Manipal), Bengaluru (Namma Naadi) Shimoga (Radio Shivamogga), Kolar (Namma Dhwani), and Belgaum (Venudhwani). Kutuhali, a free e-magazine produced by Vigyan Prasar also shares Janasuddi with around 4000 readers.

Secret sauce

“The aim of Janasuddi is to tell science stories rather than translate them from English”. says Sharma who is least daunted by jargons in research articles and considers them just as a means of masking ambiguity. Besides regular shows on the latest research, scientific topics, or interviews with scientists, Janasuddi has presented Charles Darwin's “The Voyage of the Beagle” serialised in Kannada (now at its 184th episode), as also Janaarime” from The Wire column “More fun than fun” by Raghavendra Gadagkar, Honorary Professor, Indian Institute of Science (IISc), Bengaluru. ‘Serendipity’, a book on the history of medicine by Dr. Kiran V.S. received the best Science Book of 2020-21 in medicine by the Karnataka Science & Technology Academy, was presented as a serial (52 episodes) in Janasuddi before publication.

Sharma adds that Janaprashne (Smart Question), a book out of Q&A podcasts on Janasuddi published by Vigyan Prasar, New Delhi has been selected for the Kannada literary award Na D'souza Prize (Children's Literature) for 2022.

Sharma notes, *“Janasuddi wants to do more shows on Indian science. Currently I get press releases from only IISc and Indian Institute of Astrophysics, Bengaluru. It would help me if Institutes and Scientists can send us news about their publications”*.

Janasuddi is created from Sharma's home using free open-source editing software, a noise-cancelling headset, and a laptop. Initially, the scripting, editing, and voice-over were all done by Sharma. A news clip in 2018 prompted many listeners from different walks of life to volunteer and thus formed a Team Janasuddi. Through diverse voices and styles of presentation, the volunteers help to increase engagement.

Sharma adds, *“In 2018 I underwent an angioplasty and was unable to speak, drink or eat well for 8 months. But Janasuddi didn't stop due to the love and commitment of the volunteers”*. Thus, during COVID times, Mrs. Bharathi K.Y., one



Sharma recording in his home with minimal setup | Photo credit: Kollegala Sharma

of the volunteers who has given voice to all the episodes of “The Voyage of the Beagle” stayed awake till around 2 AM to record to avoid the continuous noise of ambulance sirens. From January 2023, after a break of 15 months, Janasuddi has resumed on request from several teachers.

Gadagkar comments *“Sharma’s passionate and indefatigable efforts have had a tremendous influence across the Kannada-speaking world. Some of my friends and family were unaware of what kind of work I do until they read or listened to his translation of my work”*.

Dearth of funds

Janasuddi, an entirely voluntary endeavor with no institutional backing, has managed to stay independent despite nearing its 1000th episode. It has received a total funding of Rs. 25,000 from the Nagarathna Memorial Fund and Rs. 50,000 from the Pragathi Charitable Trust. Sharma notes, *“There is no governmental funding for podcasts yet. Without funding probably we can continue for as long as I can. But, my engagements have grown exponentially with the success of Janasuddi. My activities have diversified and I am left with little time”*

These days Sharma is busy not only creating the podcasts but training people, interacting with students, organising events and attending meetings as part of running Janasuddi. With funding and thus some dedicated manpower, he dreams of diversifying content especially for children, enhancing the quality of production, and setting up a proper website for the contents of Janasuddi.

Janasuddi illustrates the need to reform government funding systems to support independent science communicators like Sharma, who are engaged in impactful outreach activities. Institutional ventures often face structural constraints that hinder their sustainability and outreach. But, there are curious children, like young Sharma, and like-minded individuals eagerly awaiting access to exciting news about science and human progress, whether they reside in remote corners or major cities.

Lekha Bandopadhyay

Freelance Science Writer

Bengaluru is infusing Kaapi with curiosity

Featuring Vijay Kumar Krishnamurthy from *Kaapi with
Curiosity*

LEKHA BANDOPADHYAY



Amidst all the hustle and bustle of the cities, research institutes buzzing with exciting news hide in plain sight, almost like that hidden platform Harry Potter and his fellow wizards catch the train to Hogwarts from. But let's not forget that Hogwarts are funded by taxes paid by muggles out there. Many research institutes in India are indeed trying to open up through numerous outreach activities in diverse formats, inform stakeholders, and build a rational society. *Kaapi with Curiosity* (KwK) is one such endeavour by the International Centre for Theoretical Sciences (ICTS), Bengaluru.

Letting science talk

“Scientific works communicated in technical journals are usually unfathomable even to someone in a different area of research, let alone the common person not trained in science”, says Vijay Kumar Krishnamurthy, Professor, ICTS. Rukmini Dey, Professor, ICTS and current Convener of the ICTS Outreach Committee mentions that Krishnamurthy initiated KwK at ICTS way back in 2016.

Krishnamurthy notes, *“Outreach is one of the mandates of ICTS. As soon as we moved to our permanent campus, there were discussions to ramp up our outreach activities. I expressed interest to be part of these. After some discussion, we came up with the idea of a monthly popular lecture series. And that is how KwK was born”.*

Following institutional approval of the proposal put by Krishnamurthy along with Dey, the first talk was on October 2016 by renowned physicist Ashoke Sen about the current understanding of the universe from small to large scales. KwK is running ever since presenting interesting topics covering diverse aspects of science. During the pandemic, they moved online and renamed the series briefly as "*Kuriosity during Kuarantine*".

The talks are given in English, as the KwK speaker population has a significant international component. Krishnamurthy says, "*We are clearly aware that this restricts our audience to a certain section of society. There are some ongoing efforts to cater to multiple Indian languages, but this is a challenging task in a diverse country like India*".

Deciding the venue

Research laboratories could be great places for making exciting discoveries but ultimately they are the cubicles of scientists oozing that stifling formality. Krishnamurthy says, "*We envisaged the KwK talks to be a part of the city's culture. Much like the public enjoys any activity in the arts, music, or sports, so must science be embedded as an integral part of our daily life. Attending a scientific talk must be as relaxing as a casual outing on a Sunday afternoon*"



Glimpses from the *Kaapi with Kuriosity* lecture and interaction sessions

Photo credit: ICTS Outreach

They found the Jawaharlal Nehru Planetarium (JNP), Bengaluru to be an ideal venue owing to its central location, and relaxed atmosphere. Krishnamurthy adds, "JNP was a natural choice since a few ICTS faculty have been involved for a long time with the non-formal science education programs at JNP". A few talks also have been held at the Visveswaraya Industrial and Technological Museum, St Joseph's College, and Christ College in Bengaluru.

Finding the Faradays

Krishnamurthy mentions that one of the motivations of KwK was the famous Christmas Lectures held at the Royal Institution (RI) of Great Britain, given on

various aspects of physics and mathematics meant for the general public. These were started in 1825 by eminent scientist Michael Faraday, who gave around 19 lectures from 1827 to 1867 during his tenure as the Director of RI.

As part of their scientific activities, ICTS attracts a significant number of prominent scientists from India and abroad. Krishnamurthy says, ***“Tapping into this dynamic visitor pool, the outreach team looks for KwK speakers several months in advance. A potential KwK speaker is an excellent communicator of science, can connect to everyday life, and can explain their topic in a very accessible manner without the use of jargon”.***

They aim to show that science is a human activity and that scientists are humans just like anyone else. In addition, the KwK series aims to showcase scientists actively working at Indian institutions to demonstrate that science as a career is achievable in India. *“How else would one inculcate self-confidence for the next generation”?* asks Krishnamurthy.

The driving power

Finding a venue and a speaker isn't enough. Running a monthly event like KwK, demands a lot of work and monetary support. The up-to-date webpage of KwK archives every single talk linking to the YouTube channel of ICTS. Who is managing all these additional responsibilities in a research institution? Krishnamurthy reminds, *“Being part of the mandate of ICTS, KwK is funded by the institution. Over the years, ICTS has ramped up the number of outreach activities and now has a significantly sized team dedicated to outreach”.*

The drill starts with designing a visually captivating poster in consultation with the speaker of the month. The news about the upcoming KwK talk is then circulated primarily through their social media handles. ICTS and JNP coordinate several logistical arrangements and the outreach, transport, and catering teams work together. Krishnamurthy notes, *“Over the years, all these processes have smoothed into a well-oiled machine and work flawlessly”.* He also thinks that the development of science communication as a career option with a rising number of opportunities is bound to have a significant impact on the practice of science.

Rising footfall

“The day of the KwK talk is very exciting. Most talks include a prolonged interaction of the audience with the speaker over a cup of kaapi. Seeing the bright curious eyes of the audience and the often heard/seen ‘Aha moments’ really make our day”! exclaims Krishnamurthy.

Kwk receives a footfall of around 150 to 200 people. Before the pandemic it even crossed the seating capacity of the JNP auditorium at times, requiring the arrangement of projectors in adjacent rooms. The audience aged 8 to 80, comprises a mixture of high school and college students, and working professionals curious about scientific happenings.

Krishnamurthy mentions that *“Over the years, KwK has created a buzz in the city. Groups of similar-minded people have formed a community and are quite regular in all our talks. This is very important since an appreciation for science cannot be built overnight”*. The KwK talks broadcasted through the YouTube channel of ICTS extend the reach further as reflected in the number of views and appreciative comments regarding their clarity and curiosity quotient.



After-talk interaction of audience with Kaapi with Kuriosity speakers

Photo credit: ICTS Outreach

Lekha Banerjee

Freelance Science Writer



IMPACT OF THE
INDIABIOSCIENCE
OUTREACH GRANTS

3.1.

The IOG Story: How a discussion at the 10th YIM led to a 'first-of-its-kind' outreach grant for Young Investigators in India

KARISHMA S KAUSHIK & SMITA JAIN



The IndiaBioscience Outreach Grants (IOG) idea emerged from a discussion at the 10th Young Investigators' Meeting (YIM) in Thiruvananthapuram. Early-career scientists, senior scientists, and mentors from across India brainstormed about the need to build science outreach practices into research laboratories. This intention was driven by the onus on individual scientists and research organisations to ensure that they communicated science and ploughed their scientific expertise back into the community, as well as the role and need for scientific thought and rationale to shape national conversations.

In 2020, these seed conversations were formalised into the IndiaBioscience Outreach Grants (IOG) program, led by Smita Jain and Shantala Hari Dass. The program intended to positively change the Young Investigators' community in India by promoting and supporting scientist-driven outreach endeavours. The pilot round of IOG was opened for YIM and Regional YIM alumni and, given pandemic-related constraints, focused on digital initiatives.

The response to this 'first-of-its-kind' grant in India was tremendous. The IOG call received applications from all over India, including cities and towns beyond the significant scientific hubs. Notably, the applicant profile featured Young Investigators'

from diverse organisations, including IITs, IISERs, national research institutes, and central, state, and private universities. The proposed outreach ideas were also wide-ranging, from citizen science, DIY approaches, showcasing scientists and scientific research from across India, communicating advanced science to school students, and included domains of science such as cell biology, forest conservation, food security, and medicinal plants, to name a few.

Across subsequent years, the IOG call has expanded to being open to Young Investigators' in the country (defined as those under eight years into independent positions) and in-person and digital modes of outreach. IOG projects have included modes of engagement such as webinars, podcasts, videos, apps, infographics, in-person hands-on workshops, stage performances, zine books, crosswords, and quizzes. The awardees have built outreach projects catering to school students, indigenous communities, undergraduate science students, educators, and people with disabilities. From rural Jaisalmer to the Andaman and Nicobar Islands, IOG projects have been executed in schools, forest areas, care centres, scientific laboratories, and even the comfort of home! To build their IOG projects, Young Investigators have collaborated with science writers, science illustrators, public engagement professionals, citizen science experts, filmmakers, Ph.D. researchers, and undergraduate students.

Across four years, IOG has grown to be one of India's foremost science outreach grants for Young Investigators', and the IOG community has grown into a group of passionate and committed scientists engaged in science outreach. As IOG enters its fifth year, the goal of positively influencing the practice and culture of science outreach in the life sciences in India and making citizens of India more science-curious has stayed central to the program's vision. The onward vision is to continue to support a diverse range of impactful, sustainable, and innovative projects that owing to a cascading effect will, in the short term, make outreach an integral part of scientific laboratories in India and, in the long term, impact social change driven by science across our country.

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3.2. Impact of IndiaBioscience Outreach Grants

Lead applicants



- Beneficiaries
- School students
 - Undergraduates
 - Educators
 - People with disabilities
 - Indigenous communities
 - Adults

Total grants awarded **25**

Total grant money awarded **₹ 27.5 Lakh**

Total number of beneficiaries from 2020-2023 **17841**

2023 - 2024

First time - 5
Extension - 2
₹ 8 Lakh

2022 - 2023

First time - 5
Extension - 2
₹ 8 Lakh

2021 - 2022

First time - 5
Extension - 1
₹ 6.5 Lakh

2020 - 2021

First time - 5
Extension - 0
₹ 5 Lakh

Started in 2020 - 1st call

4th cycle of grants in 2023-2024

5th cycle in 2024-2025

Modes of engagement

In-person

Digital



Collaborators

- Science communicators
- Science writers
- Science illustrators
- Citizen science experts
- Filmakers
- Ph.D. researchers
- Undergraduates

Diversity of engagement

- Webinars
- Podcasts
- Videos
- Hands-on workshops
- Science trivia & activities
- Stage plays
- Art-based
- Infographics
- Calendars
- Outreach
- Photography
- Science books & e-books



FEATURED INDIABIOSCIENCE
OUTREACH GRANTS
AWARDEES

A COMPILATION BY ANKITA RATHORE

4.1.

The making of Project RAKSHA: Reach and Advocacy for Autistic Kids' Sexual Health and Safety Attitudes

Featuring Reuben Varghese, Pradyumna Murali, Hema Nair,
Mansi Karnad & Ridha Fameen

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REUBEN VARGHESE, PRADYUMNA MURALI, HEMA NAIR,
MANSI KARNAD & RIDHA FAMEEN



Project RAKSHA supported by the 2nd IndiaBioscience Outreach Grants. This dream project of passionate speech-language pathologists created an e-resource booklet providing culturally sensitive, illustration-based stories to guide parents and caregivers in communicating about reproductive and sexual health and safety to children with autism spectrum disorder (ASD). Read this article to know behind the scenes of this IOG project.

"It's important to talk to children about sex and safety", said the presenter.

I let out a sigh and muttered, *"But how"?*

Recently, my colleague Mansi and I attended a workshop that emphasised the importance of discussing sex and safety with children. However, we left feeling frustrated because no one addressed the critical question of how to start this conversation. As speech-language pathologists working with children with disabilities, who are at higher risk of sexual abuse, we wanted to include this topic in our lesson plans. Still, we didn't know where to begin or what to cover.

The available resources were lacklustre and failed to explain the subject matter adequately, had poor illustrations, lacked basic concepts needed to comprehend the materials, or required purchasing. I remember turning to Mansi and saying, “We’re *back where we started*”. We needed resources that were direct, simple, and easy to understand.

It all started when Hema, a determined undergraduate student, walked into our mentor’s office with a burning desire to apply for [the 2nd IndiaBioscience Outreach Grants](#). And from that moment, our team was born, with Reuben leading the charge and myself as co-lead, along with Mansi, Hema, and Ridha. As we brainstormed ideas, I pitched my passion project to create sexual health materials for children with disabilities, and the team loved it. So if the grant came through, we were going to be incentivised to do something we always wanted to. And after a few weeks of nerve-wracking wait, we learned that we had been selected as one of the top five finalists out of over sixty applicants. We were ecstatic to receive the grant and excited to make our mark on the world.

CATCH-22: The grant was ‘outreach’. We wanted to be different from the workshops we attended. We wanted to outreach. But with what?

Navigating the first steps

With Project RAKSHA, we wanted to teach children, especially those with disabilities, about sexual health and safety. This would directly impact children’s sexual health understanding and promote positive safety attitudes.

“So here we were, a group of enthusiastic speech-language pathologists wanting to address an important gap in outreach on reproductive and sexual health. But with inclusivity in approach and audience”.

Our goal was to create and distribute culturally sensitive illustration-based stories in English and Hindi. It would be an e-resource booklet that guides parents and caregivers in communicating about reproductive and sexual health and safety to children with autism spectrum disorder (ASD).

We researched, wrote, edited, translated and illustrated the stories with painstaking care, keeping in mind the rich tapestry of values that make up the Indian context. We decided to spend the first month finalising an outline for each domain of the scientific illustration-based resource. The following 3 months were dedicated to story writing and designing illustrations. The next 4 months were spent on content validation, rating, and final revisions. And the last 4 months were dedicated to final copy circulation, beneficiary feedback, and final report writing.

The team understood the importance of having a motivated artist, especially for successfully completing the project’s initial phase. However, we faced some setbacks due to the hired artist’s unavailability. So, we brought in a speech-language pathologist as an artist, which helped things go more smoothly.

The final outcome

We developed culturally sensitive materials tailored for vulnerable populations, specifically children with autism spectrum disorders. Our audience included children and adolescents aged 6 years and older, parents, educators, and developmental interventionists.

To ensure accuracy, our materials were reviewed by a Developmental Paediatrician, a Special Educator, and a Speech Language Pathologist. The stories we created were not intended for independent reading by children, but instead for parents, caregivers, and professionals in the (re)habilitation field.

The illustrations are simple and direct, so you can adjust the language to suit your child’s abilities. We recommend working with a Speech-Language Pathologist to incorporate augmentative and alternative communication strategies if needed.

Our stories were designed to spark discussion and questions among adults, so they can feel prepared and comfortable with the key concepts addressed. Each story comes with general instructions that we strongly recommend following to facilitate healthy and accurate learning.



THEMES 1- 10	
1. Privacy: Private body parts, things, and places	6. Seeking support: asking for help
2. Rules about touching yourself	7. Sharing unpleasant incident: Keeping no secrets
3. Rules about touching others	8. Pubertal Changes: Changing bodies and needs
4. Being naked: Where and around whom?	9. Menstruation and related care
5. Consent: Saying "NO"	10. Reproduction: Where do babies come from?

Illustrations from stories and theme lists

Themes 1–7 are appropriate for children aged 4 and above, while themes 8 – 10 are better suited for children over 9 – 11 years old. When first introducing the stories, it’s important to follow the order of themes, but when revisiting concepts later on, it’s okay to skip ahead to the relevant theme.

Our first trial run

Before giving the resource to the country, we decided to test it ourselves to ensure it was effective. In our pilot study, we trained 54 caregivers from diverse backgrounds, including dads, moms, grandmas, conservatives, liberals, and people from various socio-economic levels, religions, and communities, for about 10 days. To our delight, there was no resistance, and everyone accepted the need for sexual health and safety education for their children. We even gave them the option to provide written feedback privately and anonymously, and not a single person opposed the idea!

Comments from parents:

"...much needed resource"
- Father of a 5yo autistic child

"No professional we ever met since 8-9 years of therapy has ever addressed our concerns regarding privacy, appropriate sexual behaviours, etc. We are really glad you guys integrate these goals into intervention plan for all kids"
- Mother and Father of 13yo autistic child

"Never imagined our bachchi will also grow up and would need to be educated on such matters. Bohut bohut thanks aapko!"
- Grandma of 11yo child with Down Syndrome

"Thank you for opening our eyes to such sensitive topics"
-Mother of 6yo autistic child



Comments from parents after the 10-days hands-on workshop

Unintended but happy outcome – we crafted our stories with the intention of being inclusive and welcoming to the neurodivergent population. But, the best part is that these stories can be enjoyed by all children, regardless of their unique abilities or challenges.

Looking back, developing the story series may not have been a typical “outreach” effort for the most part. Still, the team poured their hearts and souls into the project for months, resulting in a successful pilot program that educated 54 parent-child pairs. They dedicated themselves to creating materials that could make a real difference, and their passion and commitment shine through in the final product.

We’re thrilled to announce that our stories are now available for use, and the best part is, they’re completely FREE! [This resource](#) is a must-have for all parents and rehabilitation professionals, and we’re happy to offer it in both English and Hindi.

“We promised, and we delivered. But our outreach efforts are just beginning”!

If you have any questions or feedback, please reach out to us at projectrakshaforasd@gmail.com. We're also interested in collaborating with individuals and organisations to raise funds and further our plans. Let's work together to make a difference!

*Reuben Varghese, Pradyumna Murali, Hema Nair,
Mansi Karnad, & Richa Fameen*

Project RAKSHA

The Mind Gala initiative: Exploring the wonders of the brain!

Featuring Poonam Thakur, Jhillika Trisal & Sai Dharsini

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POONAM THAKUR, JHILLIKA TRISAL & SAI DHARSINI



Mind Gala is one of the projects that received the 2nd IndiaBioscience Outreach Grants. It is a pan-India neuroscience outreach initiative led by Poonam Thakur, Assistant Professor, IISER Thiruvananthapuram, and a team of passionate neuroscience enthusiasts from Project Encephalon. The initiative aims to cultivate a deeper understanding of neuroscience and make brain sciences more accessible to high school and college students through its diverse array of webinars, workshops, and mentorship programs.

“We only use ten percent of our brains”!

“Your brain rots by playing video games”.

How many times have we heard these statements? Umpteen! Myths like these have become so prevalent that many of us grow up believing they hold some truth. Undoubtedly, the brain is the most fascinating yet the least understood organ. As a society, we often turn to electronic media, sci-fi movies, and the news as convenient sources of information about the brain. Unfortunately, these sources often portray a distorted image of the brain and even propagate wrong information, fuelling one of the deadliest modern pandemics: misinformation.

The lack of neuroscience education at the high school and undergraduate levels in India also deprives students of the opportunity to learn about this beautiful organ from a scientific perspective. Our society's brain awareness remains considerably low despite the abundance of scientific and educational resources on the subject.

The technical nature of these resources contributes to the perception that neuroscience is a complicated subject, which dissuades many competent students from pursuing it as a field of study. However, it's essential to acknowledge that the idea of neuroscience being complicated isn't entirely unfounded.

Setting the stage

In September 2021, during an informal Google meet call, a group of individuals came together with a mission to address this crucial need of encouraging Indian students to explore neuroscience. This collective brainstorming session gave birth to the concept of [Mind Gala](#), a pan-India neuroscience outreach initiative that received funding from the [2nd IndiaBioscience Outreach Grants \(IOG\)](#). The Mind Gala was co-founded by [Poonam Thakur](#), the Principal Investigator of the [Thakur Neurodegeneration Lab](#) at [IISER Thiruvananthapuram](#), and a team of passionate neuroscience enthusiasts from [Project Encephalon](#).

The primary aim of the Mind Gala is to make the field of brain sciences more accessible and appealing to high school and college students. Through the engaging '[Bheja Fry](#)' webinar series, led by various neuroscientists, the initiative seeks to unravel the complexities of the brain by presenting them in a comprehensible way. These webinars delve into daily-life neuroscience phenomena, offer lab tours, host panel discussions, conduct workshops, and provide numerous opportunities for students to explore and appreciate the wonders of neuroscience.

By offering such interactive and informative sessions, the Mind Gala aims to spark curiosity and foster a deeper understanding of the brain among the younger generation.

Reaching out to the community

The '[Science Communication Workshop](#)', along with our 'Science Writing Mentorship Program', emerged as a major highlight of the Mind Gala initiative. This engaging workshop was specifically designed to introduce beginners to the art of science communication, providing them with an invaluable experience.

During the workshop, science communication practitioners delved into various

relevant topics, covering everything from designing effective two-way science communication programs to utilising storytelling techniques for conveying scientific concepts. Also, they offered insights into developing low-cost science communication projects.

Through interactive sessions and practical exercises, participants had the opportunity to gain hands-on experience in crafting compelling scientific narratives and communicating complex ideas in a clear and engaging manner. The workshop fostered a supportive environment that encourage active participation, collaboration, and the exchange of ideas among attendees. One particularly special session was led by Pankaj Seth, General Secretary of the Indian Academy of Neurosciences (IAN). He appraised the students about the myriad of resources and opportunities provided by IAN.

The impact of our workshop was remarkable, as it garnered participation from over 100 students across the country.

Mentored approach

The Mind Gala's 'Science Writing Mentorship Program' was an outstanding opportunity for aspiring science writers to receive personalised guidance and mentorship from experienced professionals in the field. Participants had the chance to refine their writing skills, receive constructive feedback, and learn the intricacies of science communication in neuroscience through one-on-one interactions with mentors.

Out of a highly qualified pool of over 200 applicants, we carefully selected 69 talented aspiring science communicators. Each of them was paired with one of our 10 mentors, who either had a background in science communication or were early-career neuroscientists. Over the course of 10 weeks, the mentor-mentee teams collaboratively worked on writing articles that explained various concepts in neuroscience.

One of our mentors, Annapoorna PK, shared her experience, highlighting how she found the transition to teaching popular science writing to be a rewarding challenge. The exchange of ideas with her mentees provided unique perspectives and enriched her own understanding of the subjects.

The topics covered a broad spectrum, ranging from fundamental subjects like neural regeneration and brain ageing to areas of brain health and disease, neurotechnology, and daily-life neuroscientific phenomena such as dreams, learning, and memory. Mental health topics were also included to ensure a well-rounded understanding of neuroscience's relevance in our lives.

Throughout the program, our mentees received invaluable guidance from their mentors, who shared their insights and expertise in effective science communication. By refining their writing pieces, the mentees learned to communicate complex neuroscientific concepts in the simplest way possible.

Nishtha Bhargava, a mentee during the program, appreciated the program's impact, stating, "The best part of the whole experience was the intensity and depth of research that the program and mentors encouraged us to pursue for our chosen topics".

The way forward

The Mind Gala initiative reached its culmination with the publication of the popular neuroscience book, 'Tales of Neuroscience', on April 27, 2023 at the IISER Thiruvananthapuram campus. The momentous event celebrated the collaborative efforts of 69 authors, 10 mentors, and a team of over 25 volunteers from Project Encephalon, all of whom worked tirelessly to ensure the flawless execution of our programs.

The book launch witnessed an enthusiastic participation from over 100 attendees, both in-person and virtually through hybrid mode. The excitement was further amplified by the presence of J.N. Moorthy, the Honourable Director of IISER Thiruvananthapuram, and Murty Srinivasula, the Deputy Director of IISER Thiruvananthapuram, who graced the occasion as the Guests of Honor.

The 'Tales of Neuroscience' book is a collection of engaging narratives that span a wide range of fascinating topics. From exploring the neurobiology of beauty to delving into a heartfelt memoir of a son who lost his father to Multiple Sclerosis, and even understanding depression from an evolutionary perspective, there's in this book for everyone.

The stories in the book present complex scientific concepts in an engaging and relatable manner with a hope to ignite curiosity, inspire learning, and foster a deeper appreciation for the wonders of the brain. Whether you are a student embarking on your neuro-journey and seeking the right resources, or an experienced neuroscientist looking to rekindle the curiosity of a beginner, this book promises to take you on an intriguing journey of discovery.

Poonam Thakur, Jhilkika Trisal & Sai Dharsini

Mind Gala

Behind the scenes with Talk To A Scientist

Featuring Karishma S Kaushik & Snehal Kadam

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JOEL P. JOSEPH



Talk To A Scientist (TTAS) is a weekly webinar platform for children aged 6 – 16 years. TTAS is supported by the of 1st IndiaBioscience Outreach Grants. In this article, Joel uncovers the journey, experiences, logistics, highs and lows of running an outreach program intended for children in India.

It is 5 PM on a Saturday. A group of children are glued to their screens, awaiting the host's permission to join the week's episode of Talk To A Scientist (TTAS).

Week after week, children from across the country have been tuning in to this webinar platform co-founded by Karishma S. Kaushik, Assistant Professor, Savitribai Phule Pune University (SPPU), Pune, and Snehal Kadam, PhD student, Hull York Medical School, University of Hull, Hull, United Kingdom.

It started as a one-time webinar on the novel coronavirus for children amidst a lockdown on 30 March, 2020. Thanks to the participants who asked when the next session would be organised, Kaushik and Kadam decided to make it a weekly event. The program has been running successfully for over a year and a half in the form of a thematic series: each season having ten episodes, the finale being a hands-on session. Along the way, TTAS has received prestigious national

and international outreach grants, including the [IndiaBioscience Outreach Grants \(IOG\)](#). The co-founders' faces light up even as they describe how this 'passion project' started.

"If you ask a child to name a few Indian scientists, perhaps they will say names like C. V. Raman, Srinivasa Ramanujan, Homi Bhabha, Vikram Sarabhai, Janaki Ammal, Kamala Sohonie or Anandibai Joshi", Kaushik says. "But nobody will name scientists like Manu Awasthi (a computer scientist), Avinash Sharma (who was part of an Indian expedition to Antarctica) or Bhaktee Dongaonkar (who studies memory and learning). It is important to know about contemporary scientists, living and working in India in a very different time from Raman and Ramanujan. Further, all of us scientists are funded on public money – money from Indian taxpayer families – so it is our national duty to inform and engage them with ongoing scientific pursuits in the country". So, Kaushik and Kadam decided to fill this gap by introducing and engaging 6–16-year-old kids to contemporary science and scientists in India, and it has been a rewarding journey.

As the show runs successfully and amasses support from various quarters, it is the passion and drive of the co-founders, and the enormous work that goes on behind the scenes that ensures the show goes on. *"When you think about it, it is a lot of things to be done on a weekly basis", Kadam explains. "Every week, you need to spend several hours before the session preparing the content or going through the content of guest speakers to make it understandable and appropriate for the kids. And then, there is the management aspect: preparing posters for social media, sending out e-mail links, responding to queries, coordinating with the guest speakers, and so on".*

While Kaushik and Kadam are proud of their platform, they also gracefully acknowledge its limitations. *"Having said that (we catered to an existing gap), we don't plug all gaps", Kaushik says. "We are not multilingual, and we are internet-based. We recognise that we cannot communicate in Kannada, Telugu, Bhojpuri, and every language in India. We also can't reach children and families who don't have internet access. But I think it is important to recognise that outreach cannot have a 'one-size-fits-all' formula".*

Kadam adds, *"Any communication form will have its limitations. If we chose to reach the children offline and visit schools, we would be limited by geography. We would then have to restrict ourselves to the schools in Pune. It was really important for us to accept that we can't do everything, and there is always going to be a segment or situation we cannot cater to".*

Not only did the duo realise the limitations of the platform, but they also came to terms with the limitations of their scientific expertise, and the need to open up the platform to the scientific ecosystem. They had embarked on the project all by themselves, from preparing content to managing the show. However, they soon realised that they could talk to the kids only about a few topics. *“Even within biology, there are specific areas that we cannot explain adequately enough”,* Kadam says. *“For example, I don’t think I would feel confident about explaining the nitty-gritty of neuroscience even though I have a basic understanding of the field. Having heard the kind of questions these kids were asking, within the first few sessions, we realised that the show would need expert speakers”.*

The team was happy to invite like-minded experts to talk to these children. To their surprise, they received an overwhelming response from the expert community – to the point that they have to put guest speakers on a waitlist!

“I think this gave the platform a different edge”, Kadam says. *“This also freed us up a bit, giving us time to plan the sessions better”.* So far, TTAS has featured more than 60 guest speakers, introducing the kids to a range of topics from astrobiology, the working of the internet, plant communication to sleep in mammals.

Further, having younger role models as guest speakers (undergraduate, Master’s, and PhD students) has helped the children a lot, as Kaushik and Kadam say. The show has also hosted people who explained the science behind their work or pursuit – say, in breadmaking or pistol shooting – to the great enthusiasm of kids. This exercise has, in a sense, broadened the definition of a scientist for these kids – from the stereotype of senior academic researchers or industry experts to anyone who applies science in their study and work.

In some ways, TTAS has also helped the co-founders realise their childhood dreams. *“The first time I met a scientist was when I was around 17 years old, and that was only because I decided to pursue science. Had I decided otherwise, I don’t think I would have ever met a scientist in my life”,* Kadam says. *“So, for these kids to meet with scientists at such a young age and know that there are these actual people that they’ve met and can approach with a question, opens up many possibilities”.*

The road, however, has not always been smooth. While there have been days when the hosts are so overwhelmed by the number of participants that they have had to quickly stream on YouTube, there have also been days when few kids have shown up. But this has not deterred them because they have a different definition of growth.

“While most platforms define growth in numbers, it has never been the case for TTAS”, Kaushik says. “For us, the main purpose is to inspire. So, we have focused rather on building a rapport with the kids who show up week after week and making a difference in their view of science and scientists”.

“We can see (that difference) in the kind of questions they ask now versus those they asked in the first session”, Kadam adds. “We have had scientists tell us that the questions the kids are asking are open research questions in the field”.

Drawing close to the first IOG, and embarking on the extension grant with scale-up plans, the duo says that running an outreach program demands exceptional professionalism, almost like a ‘second full-time job’, contrary to the notion of science outreach being a ‘soft job’. TTAS has also recently received a grant from the American Geophysical Union (AGU) to publish archived content, based on edited recordings of the sessions, to expand its reach to settings with limited resources.

*“The stakes are really high”, Kaushik says. **“You can’t let kids down when they show up with eager faces asking, ‘when are we starting, ma’am?’, ‘who’s the guest scientist, ma’am?’, and ‘what’s the next session, ma’am?’”***

Joel P. Joseph

Freelance Science Writer

The untold stories: Bringing to light a researcher's scientific journey

Featuring Aprotim Mazumder & Anusheela Chatterjee

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ANUSHEELA CHATTERJEE



In 2020, IndiaBioscience launched the IndiaBioscience Outreach Grants (IOG) of one-lakh rupees to encourage innovative outreach ideas. Anusheela Chatterjee and Aprotim Mazumder were among the recipients of the grants in the first cycle. Here, Chatterjee recounts her team's experience of making a video series on the often-unnoticed stories of a researcher's journey in a scientific inquiry.

Manuscript accepted

These two words bring a well-deserved sense of achievement (and, quite a bit of relief!) to the researchers conducting a detailed scientific study. However, hidden behind these words are many stories — of struggles, uncertainties, failure and success. Those stories may not have had a place in formal scientific communication. Still, they would have been instrumental in training the researchers in their path of scientific inquiry.

I was often intrigued by how and where the researchers began when they embarked on a project months before. What was the roadmap like when they set out to solve that scientific riddle?

I wanted to bring to light these hidden stories. So, in July 2020, I was motivated to try my thought when IndiaBioscience announced the 1st IndiaBioscience Outreach Grants (IOG) for innovative outreach ideas in life sciences. I approached my colleagues P. K. Madhu and Aprotim Mazumder at the [Tata Institute of Fundamental Research, Hyderabad \(TIFRH\)](#), with a rough sketch of the concept. The idea was well-received and Mazumder came on board for the project.

The IOG gave wings to our objective when we were selected as one of the awardees for the first grant cycle. The year's theme focused on digital initiatives, which inspired us to explore a video format to bring these stories to light.

We decided to pick a study, engage with the researcher steering the work, and trace their research journey from the time they started designing the first experiment. The possibility of creating a repository of the untold stories of scientific research was exciting.

Initial forays, tweaks and turns

Initially, we planned to convey each story through a series of 90-second videos. Also, we thought illustrations would add quality to the storytelling, so we joined forces with freelance illustrators Rutuja Chalke and Sumit Chavan. Their artwork would give a clearer picture of the research and help create compelling stories.

We wanted to highlight four stories from TIFRH. We chose research findings from Tamal Das's lab for the first story. One fascinating ongoing investigation was about how organelles inside cells change their positions to facilitate the movement of a group of cells together, for example, when they have to seal the gap caused by a wound.

On Das's suggestion, we showcased the factors influencing the movement of a group of epithelial cells.

Once the initial round of discussions with the researchers steering the projects was over, we gathered at the drawing board. We aimed to convey the research findings in one compact series. However, as we went into the details, we found that our line of thought was quite ambitious. It was challenging to bring out the intricate network of cell biology connections in a simple, logical, and sequential manner.

At this juncture, we attended an awardees' meet-up organised by IndiaBioscience. This meeting enabled us to brainstorm ideas for overcoming the challenges, and we received crucial feedback to keep things simple. We realised we had overlooked a key simplifying factor.

There was a common thread between the studies: Each research took a different path to unravel the same complex molecular mechanism inside cells. Among these studies, we picked two studies at similar stages of the investigation highlighting how two organelles, lysosomes and Golgi, help regulate the collective cell movement.

While Rituraj Marwaha, a postdoctoral fellow, worked on the role of lysosomes, Purnati Khuntia, a graduate student, investigated what the Golgi was doing. We altered our story format slightly, incorporating a common introduction to the problem. Several doubts, clarifications and discussions followed.

“All the questions were useful and necessary for the project to develop naturally and be appreciated in greater detail”, remarks Khuntia. Chalke recounts benefiting from the detailed discussions before every project: **“From creating rough sketches to final drafts, each step challenged my creative skills, and the result was worth all the effort”.**

Options galore

Though this project aimed to bring out stories from the life sciences, the interdisciplinary fabric of TIFRH allowed us to explore some more options. For example, while the earlier project was underway, the next story—Souvik Sadhukhan’s first stint in interdisciplinary research—began to take shape. Sadhukhan, a physics graduate student in Saroj K Nandi’s lab, had developed a theoretical understanding of how a densely packed cell layer exhibits dynamics similar to that of glass molecules.

At this point, we were working on three stories simultaneously. The filming process began with the series on Sadhukhan’s research. Initially, we chose to have a voice-over for the video interspersed with the researcher’s interview. However, after going through the playback of the videos, we understood that adhering to a pre-written script would be better. That way, we could tailor it for a non-expert audience and maintain continuity for an engaging storyline.

We revised the script and made the researchers read it out so that there was no scope for technical words to enter the narrative. We even resorted to jugaad: designing a makeshift prompter by scrolling PowerPoint slides with extra-large font text! The new format helped piece together a more cohesive story.

The lessons from our first attempt at filming helped shape our storytelling style for all other projects. However, by this time, we had to bid adieu to the 90-second video format as there were multiple elements in one story and breaking them every 90 seconds interrupted the flow.

Zooming into the story

While working on these three stories, we realised that the volume of information and short duration of videos did not give us much room to capture the researcher's initial challenges. So, to provide a closer look, we zoomed in on one of the milestones of the researcher's journey. This theme became the motivation for the fourth story in this project.

Sunayana Sarkar, a graduate student in Manish Jaiswal's lab, had spent months, undaunted, standardising the extraction of polyphosphates from fruit flies. It was an essential step in a new research direction the lab was exploring. Her inspiring words reflect her determination: *"Research is not easy, we learn something new in every step, and it is all about not losing the spirit and positivity, and holding on till you get it to work"*.

Basil Thurakkal, a graduate student and IOG project team member, filmed Sarkar's story in a documentary style. He says, *"I was mostly involved in the video making, rather than the science part. So trying to see the work we are doing from an outsider's point of view was an interesting exercise"*.

Once the stories were on the road to completion, Ipsa Jain, science illustrator, visually captured the essence of each project in four announcement posters.

By the end of fifteen months, we had finished working on all four stories: Two have been released: Stories from the life sciences: How do we extract polyphosphates from fruit flies? And Stories from the life sciences: What does glass and a dense layer of cells have in common? Two are awaiting a release.

However, our work does not end here. What lies ahead is the challenging task of reaching out to a wider audience and getting feedback. Their inputs will give insights into our shortcomings and equip us to tell more compelling stories.

Anusheela Chatterjee

Tata Institute of Fundamental Research — Hyderabad

Back to the Future! Our odyssey

Featuring *Tuli Dey, Surat Parvatam, Anushka Banerjee,
Kadambari Patil & Kasturi Mahadik*

This article was first published on IndiaBioscience on Sep 04, 2023

ANUSHKA BANERJEE



In the winter of 2022, the Centre for Predictive Human Model Systems team received some exhilarating news. Our lead collaborator, Tuli Dey of Savitribai Phule Pune University, had just shared an update with us; after not one, but three attempts, we had finally been awarded the IndiaBioscience Outreach Grants! Our winning proposal was a Virtual Lab series that would transport students all across India, into the heart of some of the most cutting-edge and futuristic biological technologies. Advanced science does not always have to be complicated! We aimed to break down the behind-the-scenes of the fancy experiments, give tips and tricks from laboratory peers, and render a hands-on feel to each episode. Simply speaking, we were determined to make science exciting, engaging and accessible to students from every walk of life.

In the past few months, our Virtual Lab series has released three thrilling episodes of 'Back to the Future!' or B2F. Armed with nothing but a love for all things 'filmy' and a knack for science communication, I dove headfirst into the world of videography, editing and video production. My teammate, Kadambari Patil, took up the mammoth task of curating insightful content for B2F Workbooks and made sure it had engaging graphics to prevent it from being boring. And whenever we hit a roadblock, our trusty teammates, Kasturi Mahadik and Surat

Parvatam, swooped in to help us out! From starting out as rookies to becoming a well-oiled machine (with only occasional hiccups here and there!), we've come a long way.

Episode 1: Wound-Infection-On-Chip

We began the New Year with a trip to Savitribai Phule Pune University, to film our very first episode with Karishma Kaushik and her lab (Karishma has now transitioned to serving as the Executive Director of IndiaBioscience). It was my first time in the director's seat, and I had to deal with a steep learning curve. Learning how to find the best light for filming was a challenge, as well as figuring out how to frame a cell culture hood without any obstructions in the shot and ensuring a quiet set. Eventually, I settled comfortably into the director's chair; that's when the bossy director in me took over! I found myself asking Karishma for retakes, guiding researcher Shreeya Mhade on how to deliver her lines in the best way, and motivating research fellow Nizam Shaikh when he found himself unable to control a fit of giggles.



B2F team recording the first episode at Kaushik Lab, SPPU, Pune | Photo credit: B2F team

Episode 2: Mini-Organs

In Episode 2, we split the filming into two parts. The first part took place at Tuli Dey's tumour biology lab. It was impressive to see PhD researcher Abhishek Teli's professionalism on set; he had memorised all his lines, and we managed to wrap up his segment in just one day.

It was impressive to see PhD researcher Abhishek Teli's professionalism on set; he had memorised all his lines, and we managed to wrap up his segment in just one day.

While at her lab, I took the opportunity to interview Tuli about her experience and her thoughts on how the series was shaping up. Tuli expressed,

“It was a refreshing break from the day-to-day work and I particularly enjoyed interacting with students at the Discussion Circle”.

She hoped that future episodes would include more open-ended questions to encourage deeper intellectual engagement.



Behind the scenes from the second episode at Tumor Biology Lab, SPPU, Pune

Photo Credit: B2F team

Moving on to the second half, we shifted to Indumathi Mariappan’s retinal organoid lab at LV Prasad Eye Institute in Hyderabad. Kadambari was absolutely thrilled to witness Divya Pidishetty, Trupti Agrawal and Sudipta Mahato expertly handling reagents and growth media, which she had only seen as icons while using the illustration application BioRender! As the director, I faced an interesting challenge during this shoot. I needed to position my camera close to a biosafety hood to get the perfect shot without interfering with an ongoing real-time experiment. The solution? Meticulous sanitisation! I wiped down every part of the camera with disinfectant and donned a biohazard gown, scrub cap and gloves.



Some glimpses from the second episode at Mariappan Lab, LVPEI, Hyderabad

Photo Credit: B2F team

Episode 3: Mathematical Modelling and Biology

In Episode 3, our filming journey took us to Chennai, where we explored computational biology tools at Vantage Research. We were anxious as we weren't as acquainted with the topic, but the team at Vantage made us feel right at home. They patiently explained the intricacies of PK-PD, QSP models, virtual populations, etc. giving us renewed confidence about tackling unfamiliar territories. We had insightful conversations with Rukmini Kumar and Vikram Prabhakar, which added depth to our understanding of their work as co-founders. Finally, even though mathematical modelling may seem like serious business, Dinesh Bedathuru, Maithreye R and Prakash Packrisamy managed to keep things light and enjoyable, spoiling us rotten with delicious food, fun stories, and friendly attempts at making each other laugh during filming.



Behind the scene from the third episode at Vantage Research, Chennai

Photo Credit: B2F team

Looking back, moving forward

I sat down with Kadambari to chat about our journey so far, and what the future holds for Back to the Future (B2F):

Anushka: Hey partner!

Kadambari: Hey there, Farah Khan junior!

A (laughs): How has this entire experience been for you?

K: Honestly, it's been exhilarating. Creating B2F has given me valuable insights into the day-to-day workings of a lab, how scientists plan their experiments, and how complex (and intimidating) technologies are built on simple scientific principles. I'm grateful for this opportunity.

A: Absolutely! Coming from a research background, the work wasn't entirely new to me. But the challenge of simplifying and visually presenting the scientific concepts while maintaining aesthetics has been incredibly rewarding. I never thought I'd be able to combine my passion for filmmaking and science!

K: I too enjoyed being the "creative director" on sets, ensuring the lab space looks visually appealing on camera. It's surprising how small details like tubes in the background or gloves lying around can make a difference in the final video! Filming has been quite a challenge, hasn't it?

A: Definitely. I never realised how much effort goes into creating a 30-second scene, or how many shots you have to take. And then there's the editing!

K: (sighs): Oh boy, the editing.

A: Première Pro was my biggest enemy, but I'm happy to report we're friends now (laughs). Another challenge was making script changes on the fly during filming. We often ended up scrapping our original plans entirely!

K: Can't believe we're nearing the end! What comes next for us?

A: Well, episode 4 is the first thing! (laughs) I'm really excited to show our community how researchers answer intriguing questions on attention spans and brain behaviour! Beyond that, we're already planning a Finale Lab Visit for the winners of our discussion circles.

K: It all began with a mere idea to make contemporary science and its people accessible, but now look at our baby! Can you believe we have reached 19 Indian states, 4 Union territories and 12 countries? We're going to cross a thousand views on our channel as well, and the feedback has been overwhelming!

A: The best part was learning that students had looked-up breakthrough biological advances online after watching our videos, discussed them with friends, family and teachers, and even searched for internships in these fields!

“Even the Discussion Circles have been incredibly fun and filled with smart questions from our participants. Some of our best-performing students come from smaller towns across India! It certainly drives home the message that science is for everyone”.

K: I'm grateful for this impact. In the big picture, I'd love to see this initiative

transform into a program where we travel across the country, involve governments, inform students about India's scientific edge, and convince them that they could be a part of such fantastic research too! Public awareness of science is crucial. If people learn about these topics, they'll understand their impact on their daily lives, be more informed, and support such research.

A: Power to the people! Science for everyone!

K: (laughing): Okay, okay! We better get to it, there's a lot of work left for episode 4!

A: Haha, you're right. Let's go!

Anushka Banerjee.

National Institute of Mental Health and Neuro Sciences



FEATURED SCIENTISTS
ENGAGED IN REGIONAL
LANGUAGE OUTREACH

Fun learning and a message of hope

Featuring *Karthick Balasubramanian*

JOEL P. JOSEPH



Karthick Balasubramanian (Bala) is a scientist at the Agharkar Research Institute, Pune. He studies diatoms — algae found in lakes, rivers, oceans, and soil. His research requires him to travel very often to collect diatom samples from rivers across the country. But for Bala, these travels are more than just field trips. They are also a way of communicating science.

Combining field trips with outreach

Bala's approach toward outreach is both meticulous and scientific. The outreach sessions are flanked by surveys to assess how well the kids have assimilated the science they communicate. The data could be invaluable in assessing and developing new models for classroom teaching. Moreover, the outreach has also helped their research, Bala says. For example, a few years ago a young boy asked Bala about the function of holes of different shapes and sizes in diatoms. Bala responded with the textbook answer that they help in the exchange of gases and nutrients. The student asked why there were many holes of different shapes and patterns instead of one. *"I still don't have an answer for that question after all these years of research"*, Bala says.

“I combine most of my science outreach with my fieldwork, and focus on schools, because that’s where we have some hope for change in the future”, Bala says. During their field trips, Bala and his colleagues visit schools in the vicinity of the river. They contrast the current and past images of Indian rivers with those of the developed world. “The quality of rivers in the US, Germany, Japan, etc. in the 1950s and 1960s were extremely bad when compared with those of India at the time”, Bala says. “But their rivers are now much cleaner than ours, which have gone from good to worse”. The focus is on bringing hope to the current generation that we too can restore the lost glory of our rivers. Bala and his team then discuss how diatoms can be indicators of water quality, present a drama, and sometimes have the kids accompany them to the river for a hands-on demonstration of diatom ecology.



Karthick Bala and his team interacting with school children in Pune

Photo credit: Karthick’s Lab

Early years of training in outreach

Interestingly, Bala derived his passion and model for science communication from his PhD advisor at the Centre for Ecological Sciences, Indian Institute of Science, Bangalore — T V Ramachandra. Ramachandra had a rule in the lab: once a year, every PhD student had to communicate their science to school students. He believed that, if one was unable to communicate science to children, it was because either the research question was perhaps not important enough or the presenter lacked a good understanding of the subject. So, this was also a kind of litmus test on the significance of the question on which one is conducting research. More importantly, Bala had seen the transformation science communication could bring to the generation. He had seen how children who attended the early years of an annual assessment of water quality of lakes — as part of a program that Ramachandra has been running for over 20 years now — had on to be active members of citizen

groups protecting lakes in their localities. This created a lasting impression.



Karthick Bala interacting with college students in Meghalaya during his field collection trip

Photo credit: C. Radhakrishnan

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Finding new avenues for science outreach

On moving abroad for his postdoctoral research, Bala realised that he had to find his own avenues to engage with the public. One way he did that was to continue his contribution to Tamil Wikipedia, which he had started while he was in Bangalore. At the time, there were very few who were contributing to the platform, and Bala decided to do his bit in the field of biodiversity. He started putting up pictures, some of which are sole representations of species even to this day. For example, his picture of the pig nosed frog was the sole image available under creative commons license. The picture has also found its way into many books, including Pranay Lal's famous book, "A Deep Natural History of the Indian Subcontinent".

Eventually, Tamil newspapers and magazines started carrying these articles, and one of the magazines contacted him to write a piece for their Diwali issue. That embarked Bala on a new format of science communication, which he continues to this day. He started out writing about biodiversity, and now writes about anything that makes him curious.

On his return to India, Bala was contemplating about ways to involve in science communication and outreach. At the time, a group of diatom specialists that he was a part of had designed a video game called simriver. The game simulated the change in diatoms and the corresponding change in water quality. The game was originally developed in Japan and was being translated to several international languages. A Japanese scientist, Shigeki Mayama, asked Bala if he was interested in translating this to the Indian language. Bala then explained that India had several regional languages, and that he could translate to Tamil. Bala translated the entire program in Tamil, his wife Alka translated it to Kannada, their friends translated it to Marathi, and with the help of Rachana Nautiyal, a college teacher from Dehradun, they translated the program to Hindi.



Karthick Bala and Shigeki Mayama interacting with school children in Pune

Photo credit: C. Radhakrishnan

Current work, challenges, and advise to aspiring science communicators

Bala writes extensively for the Tamil audience. Yet, unlike other regional language communicators, he has not had to face an issue in finding technical words in Tamil. Thanks to the extensive nature of Tamil lexicon dictionary. But there are other challenges that Bala faces with his science outreach activities. For instance, the difficulty in getting permission from school management, and the apathy of some.

“One should have a good command over the language in which they are communicating”, Bala says, adding that writing for children’s magazines also helps a lot, has a large reach, and is effective.

Joel P Joseph
Freelance Science Writer

A mutual and inclusive dissemination of science

Featuring Joli Rumi Borah

JOEL P. JOSEPH



In 2011, Joli Rumi Borah, a young conservation biologist from Assam, stumbled upon the Assamese Wikipedia. It was only ten years since its launch, and there was almost no information in Assamese on the internet then. The thought of searching for something on the internet in Assamese and getting results in her own language was very exciting for Borah, who had just finished her master's in wildlife sciences.

Into science communication via Assamese wiki

"I opened an account the same day, learnt how to type in Assamese on my laptop, and started contributing to Assamese Wikipedia", Borah says. That's how she found her way into the world of Assamese science communication.

She wrote about birds, plants, animals, butterflies, snakes, frogs — almost anything about which Assamese Wikipedia had little information. Over the two years, she has written more than 500 nature-related articles in Assamese Wiki.

Borah is now a senior wildlife biologist with the Government of Alberta, Canada. But she continues her science communication efforts in the Assamese language

using different formats and media, primarily writing. According to her, it was only natural for her to become a nature writer as her keen interests as a kid were nature and creative writing.

Over time, she has explored various media platforms to communicate science — print media, blogs, talks, podcasts, etc. Her articles, especially in biological sciences, have appeared in various newspapers and magazines both in English and Assamese. *“Writing has been the most meaningful and enjoyable way of communicating science for me”,* she says.

The motivation

The motivation for her communication in Assamese came from not only the lack of scientific information in the Assamese language and but also her own struggles with it. *“Growing up I had my own struggles getting access to knowledge that was not available in Assamese”,* she says. So, Borah is passionate about breaking the language barrier in science to make it more inclusive and equitable. She recently published a part

of her doctoral work conducted in Nagaland, ‘The value of shifting cultivation for biodiversity in Northeast India’, in the journal *Diversity and Distributions*. She included a transliterated version of its abstract in the lingua franca Nagamese language.



Joli Rumi Borah presenting at an Assamese Wikipedia workshop held at the Indian Institute of Science on 1 December 2013

Photo credit: Subhashish Panigrahi

Science communication: a two-way street

Borah urges those interested in science communication to consider it a “mutual learning process” and not an act of “educating the public”. The idea of science communication as an education of the public, she explains, comes because we often think of science communication as communicating knowledge acquired from research dominated by the Western world. But the knowledge acquired by indigenous people through traditional methods often goes deeper because this wealth of knowledge comes from hundreds of years of observation, experiments and attempts to adapt to the environment. There is a greater implication of this approach that Borah points out: *“Incorporating these multiple ways of knowing and doing can be a crucial step in decolonising science”.*



Mutual learning on the ground talking to farmers about Jhum cultivation in Fakim village, Nagaland

Photo credit: Limthure Yimchunger

Although she has streamlined some content for children, Borah mostly writes for a heterogeneous public audience. While writing for general Assamese audiences, she uses local contexts or examples without getting into too many technical details. While writing for children, she infuses her content with games related to nature, making it interactive and memorable. Some of these do well to invigorate their love for nature. For example, Borah wrote an article for children on [how to birdwatch](#).

Even with a diverse audience, her base recipe for nature writing is the focus on people's natural curiosity about their surroundings. *"I try to start from there and explain things in simple language to make it relatable to the general public"*, she says. This approach has helped her cross boundaries to reach people from different cultures and backgrounds. It could be her outreach to farmers on wildlife-friendly farming at the *Balmoral Show*, Ireland's largest Agri Food event, or her presentation on tropical forests to children at *Discovery Night* at the Department of Animal and Plant Sciences, University of Sheffield, UK.



Left: A Children's game Joli Rumi Borah presented at *Discovery Night* at the University of Sheffield, UK.

Right: Joli Rumi Borah presenting with Cindy Cosset at *Discovery Night* at the University of Sheffield, UK.

(Left) Photo credit: Joli Rumi Borah | (Right) Photo credit: Felix Lim



Joli Rumi Borah taking part as a Conservation Advisor for the Irish farmers at the Balmoral Show in Northern Ireland | Photo credit: Katy Bell

On collaborations

While most of her work is solo, mainly due to the challenges involved in aligning the timelines in collaborations, Borah has also had some occasional collaborations — talks, interviews, translations, podcasts. These have been mostly rewarding. *“It has helped me learn new things, broaden my scope, and overall, has made me feel part of a community rather than working in isolation for science communication”*, she says.

Overcoming challenges

Borah’s journey in science communication has been mostly eventful and enjoyable, but not without challenges. The one that stands out, as in the case of almost anyone who communicates science in regional languages, is the struggle to find appropriate Assamese words for technical terms in English. As for Borah, it goes both ways. *“Many English terms do not have an equivalent Assamese word and the English equivalents of Assamese terminologies describing local phenomena are also absent”*. This is the case with names of species too, when similar species have the same Assamese common name. But there is also the challenge that comes from abundance. *“The same species might have different names in different places within Assam”*, she says. And the way she deals with it usually is to include all the existing names in both the languages and to avoid creating her own names from literal translation as much as possible. Borah also hopes that the few online and offline Assamese dictionaries on technical fields that have emerged recently will help in these aspects in future.

Even so, Borah has taken it up as a personal challenge to communicate science in Assamese as she believes that a major way to make science more inclusive and equitable is to break the language barrier and ensure that everyone has access to information in their own language. ***“I try to do my part to break that barrier and make scientific information available and accessible in my mother tongue, i.e., Assamese language”***.

Joel P Joseph
Freelance Science Writer

Bigyan: Popularising science in Bangla

Featuring Anirban Gangopadhyay, Dibyajyoti Ghosh, Kunal Chakraborty & Kazi Rajibul Islam

JOEL P. JOSEPH



February 28, 2014.

Four researchers from West Bengal — Kazi Rajibul Islam, Anirban Gangopadhyay, Dibyajyoti Ghosh, and Kunal Chakraborty — launched a website to popularise science in their mother tongue, Bangla. The venture now stands tall in science communication efforts in regional languages of India. It has attracted many accomplished scientists as volunteers, and gathered a readership of more than half a million people and nearly 30,000 followers on their [YouTube](#) and [Facebook](#) channels.

Intent and content

“We wanted to bring the latest stories from the world of scientific research to a general audience”, Gangopadhyay says.

The content on the website mainly caters to a curious audience with some basic understanding of science, regardless of their age. But the founders have consciously struck a balance popularising science without dumbing it down. *“The articles can range from simple expository articles on topical issues, such as*

climate change or gut bacteria and obesity, to more in-depth looks at specialised topics, such as the mathematics of artificial intelligence or nuances in how the central dogma of molecular biology works in practise”, Islam who is currently a professor of physics, points out. They agree that understanding the specialised topics might require some patience and perhaps a bit of interest in delving into technical details. But the team also goes a step beyond discussing science.



Bigyan in print format | Photo credit: Bigyan team

The workflow process also involves peer-review to ensure that the content is both “technically accurate” and “comprehensible” for a general audience. Moreover, they underscore the “process of research” in addition to the product – scientific findings – they present so the readers develop a “scientific mindset when trying to interpret what they hear in places such as news and social media”.

With this intent of fostering scientific temper in the masses, they have published articles, videos, and podcasts on themes like identifying misinformation in social media forwards. Although their primary format of communication is long form blogs, the team also produces short articles, sketches, posters, print magazines, etc.

The volunteers – Bigyan’s lifeline

The efforts have resonated with many scientists and educators who have joined forces as volunteers to support *Bigyan*. Such an organisational style also aligns with the organisation’s philosophy. In their own words noted in an [article](#) by Gangopadhyay and Islam in *IndiaBioscience*, **“If a person trained in science does not take up the responsibility of communicating his/her work, there is really no one else to blame when that science gets misrepresented or stays unrepresented in the media”.**

These volunteers at *Bigyan* – about 10 to 20 of them at any given time – are its lifeline, bringing “new energy, ideas, and projects” to the table. In one instance, Kausik Das, a professor of physics, volunteered to provide access to an exciting project of the United States’ National Science Foundation. It was a “science-through-cartoons” program that Das spearheaded the program with

the world-famous cartoonist Larry Gonick. The team then translated the content to Bengali and distributed it among rural high school students in West Bengal. This became a new teaching material in physics for high school students in some schools in the state as a part of their project to develop an “enhanced learning environment” in classrooms, where teachers incorporate “new teaching materials and methodology to augment the textbooks”. Motivated volunteers played a pivotal role in encouraging Bigyan to explore avenues beyond written articles. For example, Amalesh Roy, a Research and Development scientist in the pharmaceutical industry, delved into creating podcasts addressing socially significant topics. Younger volunteers like Sourya Sengupta and Soumik Ghosh, PhD students, initiated live interviews with scientists on social media channels.

Collaborative public engagement and feedback

The team goes beyond producing online content to engage with the public, particularly high school students. Besides the “science-through-cartoons” project, the team also embarked on a project of distributing foldscopes to the rural high schools of West Bengal with help from colleagues at Stanford University. They also partnered with the [Contai Science Academy \(CSA\)](#), a non-profit organisation comprising high school and college teachers in Contai, West Bengal, to publish and distribute printed magazines to expand our reach beyond the internet.

“One of the unique features of Bigyan is collaborations across geographical boundaries and scientific domains”, says Swagata Ghosh, a long-time volunteer based in Kolkata. *“It is probably our greatest strength”,* agrees Banani Mondal, who is based in Georgia, USA. The team has not only collaborated with scientists, but also with artists and celebrities like the famous radio personality and actor in Bengal, Mir Afsar Ali; the national award-winning music director, Anupam Roy; and others who have promoted *Bigyan* among their fanbase pro bono.



Launch of *Bigyan* magazine with Mir Asif Ali, an Indian radio jockey, television anchor, singer, comedian, actor and media personality

Photo credit: Bigyan team

Such collaborations have given them important feedback that has helped the team improve their quality of work. *“Some of the insights we gleaned from our interactions with educators have helped us understand gaps in current science teaching and try to address those in our articles”*, the team says.

In engaging the audience in the process, the team has designed initiatives, such as nature watch competitions and workshops. They are now working with freelancers to create more engaging secondary content like videos from their original long form articles and live interviews.

Challenges and solutions

Although there are volunteers at any given time, there are challenges in getting experts to discuss their science with the public. *“Explaining research to an audience that is not familiar with the domain can be quite challenging, and not everyone was up for the task”*, the team says. *“So, we now focus on live interviews that the volunteers then use for content in written articles”*.

The team also faces other specific to the venture being in a regional language, the following two being the major ones:

- (i) A lack of trained Bangla science writers forces the team to entirely rely on the available volunteer pool, which limits the volume of content they can publish.
- (ii) The notion that science must be written in formal language commensurate with the seriousness of the content. So, many articles that the team receives are written in dry formal Bangla that is alien to daily conversations.

They have also managed to overcome some challenges. For example, they were initially faced with problems in finding the right Bangla equivalents of technical terms and quite a few Bengali researchers not being conversant enough with Bangla to put together a scientific article. *“We mostly sidestepped the word-hunting problem by using English words for technical terms. For researchers who perceive their Bangla to be not strong enough, we offer to translate once they write an article in English”*, the team says.

All said and done, *Bigyan’s* story is a celebration of science through partnerships, teamwork, volunteering, and public engagement. Although they face many challenges, some universal and some specific to them communicating in the regional language, the team will hopefully find a way around these challenges like they have for the ones they’ve overcome.

Joel P. Joseph
Freelance Science Writer





SKILL-BUILDING RESOURCES
FOR SCIENCE OUTREACH

A practical guide for outreach-enthusiast scientists to engage with the media

SPOORTHY RAMAN



One of the social obligations of a scientist is to communicate their science to the public, who mostly fund this exciting endeavour within the labs or in the field. Media outlets, be it print, online, TV or audio can serve as a catalyst in the process, helping take the excitement of a rousing discovery or breakthrough innovation reach the masses—local and global—in the blink of an eye. So, how does a conscientious scientist meet a shoe-leather journalist, who acts like the message-bearer, and fulfil their obligation of communicating their science? Here's a practical guide.

Understand what makes it to the headlines

On any given day, the world bustles with numerous 'breaking news' stories—be it in politics, foreign affairs, business, sports or culture—that science needs to compete with for eyeballs. In the eyes of a scientist, a recently published peer-reviewed study or a new finding might be an exhilarating breakthrough. But, to pique a journalist's interest, it needs to be more than that. **For a science story to land on the front page, it has to be recent, topical, awe-inspiring, provide more evidence to a well-established but important fact, add a new dimension of knowledge, or raise further questions.** It needs to have some action—someone

doing something for a reason. Often, it needs a juicy backstory—the why of the doing. Sometimes, it needs a compelling epilogue—the impact of the doing. There’s also a critical voice—often other experts in the field and sometimes the beneficiaries of the science—weighing in on the merits and faults of the breakthrough in question. A bit of seasoning—cursed mishaps, out-of-the-blue surprises, quirky anecdotes, and powerful emotions—can spice up the story.

Spread the word about your science

Journalists are always on the lookout for good stories. They scour many science journals for recent, interesting studies, scroll Twitter and LinkedIn feeds to tap on conversations, sign up for embargoed tipsheets and attend webinars and conferences that bring together experts. Scientists can be trusted leads in this hunt by speaking out about their science through their institute’s press office, social media or personally connecting with journalists.

Some universities and institutes have press information offices or media centres that can help prepare a press release about the research and disseminate it to journalists. If scientists (and their affiliated institutes) are on social media platforms like Twitter and LinkedIn (where most journalists currently are), or on WhatsApp groups that connect scientists and journalists, they can share a link to their research, and as a bonus, add broader context around why they consider their research to be newsworthy. Journalists also love to be the first ones to break the news hot-off-the-press—so they are all ears to studies under embargo, with a note on the details of the embargo.

Put together a press kit

In the fast-paced world of journalism, ready access to information can help a journalist put together a quick, factually accurate science story. A press kit, in this regard, is a godsend. Typically, a press kit contains:

- A press release: A document explaining the findings of the study in layperson language, some contextual information of why the research is important and the implications of it to the broader field of science
- A copy of the study: Unless it is open access, it would help to send a PDF version of the study, which study authors usually have access to
- Accompanying multimedia: Science stories come alive with multimedia—photos, videos or audio clips of the team of scientists, some action in the field or lab, or of models and prototypes built as part of the research.
- Quotes from the scientist(s): Quotes help show the human side of science, so journalists love jargon-free, engaging quotes from scientists explaining their motivation behind the research, the implications of their finding, or a surprising or unexpected part of the result. Please do not copy-paste content from your study paper. Let these quotes be as conversational as possible.

- Contact information: Phone numbers and email addresses of the scientists involved, and the press information officer if available, can help a journalist reach the right people on time.

Be responsive and available

Journalists typically reach out to scientists for two primary reasons: either to talk about their research being covered, or to provide an expert opinion on work in their field that they were not a part of. For the former, journalists usually prefer a phone or Zoom conversation, or an email response, where they may like to talk to scientists first hand (even if they have a press kit at hand). Being responsive and available to these requests, or directing a journalist to alternative sources when availability is a problem, can help shine a better light on the science being covered. For the latter, if scientists can let journalists know as soon as possible if they can provide their opinion within the deadline, it can save a lot of time and effort for the journalist. If it is a no, journalists can then move on and find other experts.

Don't ask to read a draft of the story

Scientists are often sceptical about their science or quotes being misrepresented or inaccurately reported in the media. While that is understandable, and there have been instances of factual inaccuracies, a good journalist often takes steps to verify their reporting. This includes sending follow-up questions after an interview if something needs further clarification and fact-checking quotes or facts reported in the story. In the journalism world, sharing the story with a source prior to publication is frowned upon, and editorial guidelines at some media outlets prohibit it outright. When your research is being covered, do not insist on reading it before publishing but feel free to ask for a fact-check.

Invest in building a network of journalists

Media coverage of science, as much as it benefits the society, can also propel a scientist's career. So, it's good to have a network of journalists to reach out to if you have a study in the making, an ongoing exciting research, a tip for a story, or just an informed opinion or perspective about a topical issue (droughts, floods, vaccines, pandemics—there's a science angle to almost everything). It pays to invest in building such a network. A few tips on how to stay in touch with journalists:

- Connect with journalists whose work you love: Most journalists are on social media, so it is easy to find them and connect with them.
- Be a part of forums that connect journalists and scientists: In India, there is a WhatsApp group with nearly 300 scientists and science journalists. There might be similar forums on other platforms too.

- Keep the conversation going: Did a journalist reach out to you and cover your work? Tell them what you thought of their work. If possible, share it in your networks. Add their contact information to your network of journalists that you may reach out to in the future.

It takes two to tango—and that's true with science journalism too. Unprofessionalism on either side—scientists or journalists—is detrimental to communicating science. If you spot a journalist inaccurately reporting your work, be kind and educate them—most will be happy to own up and correct their mistake. Afterall, to err is human.

Spoorthy Raman

Independent Science and
Environment Journalist

Developing a strategy for your science communication project

SIDDHARTH KANKARIA



A skill-building guide for scientists and science communicators

About this guide

Scientists and science communicators often dive deep into the world of science communication with a lot of enthusiasm, but can find themselves without access to relevant skill-building avenues and resources. This often leads to knowledge gaps in how to effectively plan, implement and evaluate their science communication activities.

This practical guide is designed to precisely help in such scenarios by providing an evidence-based way for designing effective, entertaining and impactful science communication activities!

This table contains a set of critical questions and prompts that can be used for formulating a comprehensive plan and strategy for any science communication project or activity. It also contains suitable examples to help seed your own answers to these questions.

How to use this guide

Try to answer the following questions on the basis of the science communication activity or project you have in mind (these answers could range from a few bullet points, a couple of lines or even a detailed paragraph).

Key question and prompts for developing a strategy for your science communication activity/project	Examples of what answers to these questions can look like for a hypothetical activity on “Bioluminescence – Light from the Living”
<p>1. Write an appealing activity summary to help draw audiences to your activity.</p> <p>a. This summary should provide a compelling reason for people to attend and participate in your science communication activity or project.</p> <p>b. It should also sum up key aspects of your activity such as the ‘5W-H’ questions: when, where, what, why, who, & how.</p>	<p><i>“Ever wondered how fireflies turn into a natural display of flickering LEDs at night? Or why that exotic mushroom in your garden seems to glow at dusk? Visit us to take a sneak peek into the scintillating world of bioluminescence, the phenomenon of light being produced by living organisms, and discover fascinating array of ways in which organisms use bioluminescence every day!</i></p> <p><i>This table-top exhibit on bioluminescence is aimed at young children and family audiences, and will be delivered as part of our annual Science Day. Designed to showcase the diversity and ingenuity of bioluminescent processes used by various life forms in nature, the exhibit will shed light on the science behind bioluminescence and introduce audiences with some fun applications of bioluminescence in real life”!</i></p>
<p>2. What are some of the key aims and objectives of your project/activity? Try and articulate these goals at two levels</p> <p>a. Aims are more subjective, long-term and broader goals for your project.</p> <p>b. Objectives are more objective, short-term, and specific goals for your project. They are also easier to measure and evaluate than the aims usually.</p>	<p>Aims: The main aim of the exhibit is to create a congenial space for engaging people with the phenomenon of bioluminescence, and to discuss how a wide array of organisms from fireflies, fungi and deep-sea marine fishes, all use bioluminescence for an equally wide array of applications.</p> <p>Objectives: The specific objectives of this exhibit include:</p> <p>a. To spark visitors’ interest and curiosity about bioluminescence</p> <p>b. To impart knowledge and awareness about the science behind bioluminescence</p> <p>c. To inculcate an appreciation of how different organisms use bioluminescence in ingenious ways for a variety of functions</p>

<p>3. Who are intended target audience(s) of your project/ activity?</p> <p>a. Having clearly defined target audiences can help design and implement your science communication activities more meaningfully.</p> <p>b. Think about your target audience’s experiences, level of expertise, contexts as well as motivations to engage with your project, and how this can inform the delivery of your activity.</p>	<p>The proposed exhibit on bioluminescence would include a collection of activities catering to the following audiences (with varying age groups and backgrounds):</p> <p>a. Teenagers / adolescents / students (13-18 year old)</p> <p>b. Family groups (with children 5 years and above accompanied by their guardians)</p> <p>c. Young adults (18 to 28 year old)</p> <p>d. Parents (29 to 50 year old)</p> <p>e. Senior citizens / grandparents (50 years and above)</p>
<p>4. What are some of the methods or approaches you plan to use for achieving this activity?</p> <p>a. Ideally, you shouldn’t fix the format or approach to be used as part of your activity right at the beginning.</p> <p>b. Instead, decide them on the basis of your intended goals (aims and objectives), the target audiences you want to reach, and the (scientific) content you want to engage them with.</p> <p>c. You should also consider if your chosen format or approach are amenable to being measured and evaluated (see the next section for more details).</p>	<p>a. Main activity: This exhibit will encourage audiences to learn about key features of bioluminescent organisms using a colourful and interactive card-matching game.</p> <p>b. Supplementary activity: The exhibit will also have a model for explaining how bioluminescence can help deep sea marine organisms camouflage better and spark further conversations.</p> <p>c. Promotional materials: A large colourful banner about bioluminescence will form the backdrop of the exhibit, and pictures and videos of bioluminescent organisms will be displayed continuously on a laptop screen.</p> <p>d. Live attractions: Live samples of bioluminescent organisms will also be on display for visitors, including a few fireflies, some bioluminescent mushrooms, and bioluminescent bacteria within sealed petri dishes.</p> <p>e. Takeaway materials: The exhibit will also have colourful postcards for audiences to take away, and an art corner with colouring sheets for audiences to artistically engage with the exhibit themes.</p>

<p>5. What outcomes and outputs do you hope to achieve via your project?</p> <p>a. In addition to coming up with aims and objectives, it is equally critical to articulate corresponding outcomes and outputs that map your projects' expected goals to actual measurable results.</p> <p>b. Outcomes are closely mapped to objectives and describe results that you hope to see at the end of your activity. They can sometimes be intangible and more difficult to measure.</p> <p>c. Outputs are usually more tangible work products of a project that are easier to quantify and measure.</p>	<p>a. Outcomes:</p> <p>i) Audiences are visibly interested and curious about the phenomenon of bioluminescence</p> <p>ii) Audiences are more informed about different bioluminescent organisms and the various biological functions it can serve</p> <p>iii) Audiences have a better understanding of the science behind bioluminescence</p> <p>iv) Audiences are better aware of real-life applications of bioluminescence</p> <p>Outputs:</p> <p>i) To actively engage at least 200 visitors throughout the annual Science Day celebrations.</p> <p>ii) To improve visitors' understanding and awareness of the following aspects of bioluminescence:</p> <ul style="list-style-type: none"> • diversity of bioluminescent organisms • diversity of ways of producing bioluminescence • diversity of functions of bioluminescence in nature • diversity of applications of bioluminescence in real-life
<p>How will you evaluate and measure the impact of your project?</p> <p>a. Evaluation and impact measurement are often overlooked but are critical for ensuring the success of a science communication project.</p> <p>b. These can include measuring various quantitative metrics, as well as recording qualitative aspects like visitor experiences, opinions, knowledge shifts or newly acquired skills.</p>	<p>Here are some ways the exhibit would be evaluated:</p> <p>a. Number of visitors: Volunteers will record the total number of visitors at the exhibit using clickers.</p> <p>b. Interactive questions: Visitors will be asked various interactive questions as part of the activities to try and gauge their overall experiences, learnings and interests, and use these for improving the quality of engagement in real-time.</p> <p>c. Individual quantitative feedback: All visitors above the age of 12 will be requested to fill out a feedback form, to quantitatively measure any updates in their knowledge, levels of their</p>

c. Evaluation and impact measurement can be done before, during or after the activity, and using a combination of all three is usually recommended.

engagement, as well as their overall rating of the exhibit.

d. Individual qualitative feedback: There will also be a feedback board for visitors to publicly share their personal comments and feedback using post-it notes.

e. Pilot / trial run: A pre-event trial of the entire exhibit will run for a few hours within the campus, to test out various aspects of the exhibit as well as train the volunteers adequately.

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Spreading science across languages

MOUMITA MAZUMDAR AND RAGHUL M R



Science is a shared quest for understanding the mysteries of our universe. Yet, it often finds itself confined by linguistic constraints, hindering its reach to diverse and eager minds across the globe. In an increasingly interconnected world, the dissemination of scientific knowledge should transcend borders and language barriers. This chapter looks into the significance of multilingual science outreach and provides insights to embark on to initiate one's journey of scientific discovery, sharing, and collaboration.

Understanding the multilingual science outreach landscape

Science is a universal language, but not everyone speaks the same verbal one. **Multilingual science outreach ensures that the joy of science is accessible to everyone, irrespective of the language they speak.** The need for multilingual outreach projects arises because science enthusiasts, experts, and learners are scattered worldwide, each contributing their unique perspectives and ideas.

Choosing the right languages

Selecting the languages is the first step in building a multilingual science outreach project. Start by identifying your target audience and their language

preferences. Consider the demographics of the regions you wish to reach and prioritise languages accordingly. For example, if you're targeting Kannada speakers, consider translations in Kannada and modify the visuals to ensure sociocultural relevance. Additionally, look for volunteers or organisations who can help with translation.

Inclusive content creation

The heart of a multilingual science outreach project lies in creating engaging and informative content. Embrace diversity and inclusivity by featuring content that reflects various cultures, traditions, and scientific contributions worldwide. This can be achieved through articles, videos, podcasts, comics, and interactive resources.

Social media engagement

Social media is a powerful tool for multilingual science outreach. Utilise platforms like Facebook, Twitter, and Instagram to share scientific updates, fascinating discoveries, and even fun science-related language quizzes! Encourage your followers to interact with your content by commenting and sharing in their preferred languages.

Virtual science workshops

Conducting virtual science workshops is an effective way to engage multilingual audiences in real time. Offering interactive sessions on diverse scientific subjects and inviting bilingual moderators can bridge the language gap and facilitate communication.

Imagine a platform that conducts workshops and Q&A sessions where science enthusiasts and professionals from different parts of India (or different countries) contribute their thoughts on a particular topic in their native languages. Now, with the option to add language interpreters in virtual meeting tools like Zoom, you can foster this kind of multilingual dialogue where the wall of language can be broken down. It will not only encourage connections among science enthusiasts, learners, and experts from around the world but can also be a supportive environment for cross-cultural learning and collaboration – thus creating a sense of global scientific collaboration and understanding.

Translation and subtitling

To make your existing content multilingual, consider translating your articles, videos, and presentations into different languages. Additionally, add subtitles or captions to your videos to ensure that non-native speakers can follow along comfortably.

For instance, [Hashem Al-Ghaili](#), a renowned science communicator and video producer, disseminates scientific content in various languages, including different Indian languages. His videos have captions or subtitles that ensure inclusivity, accessibility, and improved comprehension for a diverse audience. Other science media channels, such as “[What If?](#)” by Underknown, also produce and translate their content in multiple languages.

Another excellent example is [Kurzgesagt – In a Nutshell](#). This Munich-based YouTube channel and animation studio produces animated science videos in English and eight other international languages, including Hindi.

The Language Project by [iGEM IIT Madras](#) produced biotechnology-based videos in 15 Indian languages and 20 foreign languages.

Building a community

Building a community of people who are willing to contribute to the creation of multilingual science communication content would be a great step. This could be a collective of scattered science communication initiatives in various regional languages across India; for instance, [Bigyan](#) produces science content in Bengali and [Janasuddi](#) produces science podcasts in Kannada. Similarly, other such initiatives can be knowledge-sharing partners, and this content can be collectively translated by the community into other Indian languages. Social media platforms like Discord can be used to create such community spaces.

Communicating without a language

Science — often considered a domain of complex terminologies and technical jargon — can transcend linguistic barriers, and captivate audiences through the language of visuals, graphics, and comics. Here's how!

1. Visual storytelling: Complex scientific ideas can be communicated visually and effectively without words. A well-crafted visual story can take the audience on a journey through the scientific process, from hypothesis to experimentation to conclusion, all without using a single word.

2. Infographics: Infographics are powerful tools for communicating information, presenting data, and providing scientific facts concisely and engagingly. A combination of icons, pictures, and charts can convey information effectively and quickly.

3. Comics and illustrations: Comics are not just for entertainment; they can be powerful educational tools. Using illustrations and sequential art, comics can

simplify scientific ideas, making them accessible and relatable to a wide range of readers.

4. Diagrams and models: Scientific ideas like the solar system or molecular architecture can be represented visually using diagrams and physical models. These visual aids allow individuals to grasp complex concepts intuitively.

5. Animations and videos: Moving visuals, like animations and videos, bring science to life. Without using words or written materials, they can effectively demonstrate scientific procedures, experiments and natural phenomena. Do you recall how we can comprehend the cartoon “Mr. Bean” without any character uttering a single word?

6. Colour and design: Scientific images can be made more appealing to the eye and easier to understand using colour and design. Colour-coded diagrams, for instance, can simplify complex charts or graphs, making them easier to understand.

7. Universal symbols: Certain symbols and icons, like that of the atom or DNA double helix, are universally recognised as scientific symbols. Incorporating these symbols into visuals can instantly convey scientific concepts.

8. Visual metaphors: Metaphors can be a powerful tool to explain complex concepts. A visual metaphor, representing the brain as a computer or the internet as a neural network, can make content more accessible.

In a country that thrives on diversity and cultural richness, multilingual science outreach projects play a crucial role in making scientific knowledge accessible to all. By building a multilingual science outreach project, we can celebrate the beauty of different languages and cultures while inspiring people to become lifelong learners and science enthusiasts.

Mounita Mazumdar and Raghul M R

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A COMPILATION OF
FUNDING RESOURCES FOR
SCIENCE OUTREACH

A COMPILATION BY MANJULA HARIKRISHNA

Grants for science outreach (India)



7.1.1. IndiaBioscience Outreach Grants | IndiaBioscience

IndiaBioscience (IBS) launched IndiaBioscience Outreach Grants (IOG) in 2020. IBS strives to promote the outreach efforts by talented scientists at the early stages of their career via the IndiaBioscience Outreach Grants (IOG) to cultivate a deeper level of interaction between the scientific community and the broader public via strategies such as sharing scientifically reliable information, fostering a scientific temperament and increasing the accessibility of scientific research.

There are two categories of IOG grants:

1. First-time Grants
2. Extension Grants

Eligibility

- **First-time Grants:** Young Investigators' (less than 8 years since starting an independent position; Ramalingaswami Re-entry Fellows, Ramanujan Fellows, DST-INSPIRE Faculty Fellows are considered independent positions), currently employed at or affiliated to a government, educational or not-for-profit research institute in India, to lead the effort - however, collaborations (with educators, students, science communicators, public engagement professionals, etc.) are strongly preferred.

- **Extension Grants:** Young Investigators who have been awarded First-time Grants in the previous cycle are eligible to apply for the Extension grants. Each team can attain this award **ONLY** once. The lead applicants should continue to be currently employed at or affiliated with a government, educational or not-for-profit research institute in India.

Support

First-time Grants: INR 1 lakh

Extension Grants: INR 1.5 lakhs

Duration

The duration of both awards is one year.

Deadline

The call for applications will be generally in the month of June/July every year.

Website

<https://indiabioscience.org/indiabioscience-outreach-grants/resources-from-indiabioscience-outreach-grant-awardees>

7.1.2. India Science Book Fellowship | FAST India

The Foundation for Advancing Science and Technology (FAST India) launched the India Science Book Fellowship for scientists, science writers, communicators and for anyone interested in writing a **popular science book in non-fiction**.

Eligibility

- Anyone based in India who is interested in writing a book based on science and technology can apply for the fellowship.
- Applicants can apply as an individual or as a team. However, the Lead applicant should be based in India and will be responsible for administering the fellowship to their collaborator.

Support

INR 10 Lakhs

Duration

The duration of the grant is **one year**.

Website

<https://www.fast-india.org/science-book-fellowship/>

7.1.3. Public Engagement | DBT/Wellcome Trust India Alliance

India Alliance offers funding to its Fellows and other researchers and public engagement practitioners in India who are interested in exploring creative and novel method(s) to engage with the public on **biomedical research**.

This funding aims to enable the applicant to develop and implement ideas to share, deliberate, and collaborate with members of society on biomedical science and/or public health matters.

Eligibility

- Anyone can apply. However, preference will be given to biomedical researchers who plan to collaborate with individuals in other disciplines, such as the creative arts, medical humanities, social sciences, science or health communication, community engagement, entertainment media, etc.
- The applicant must be affiliated with a government-recognised, not-for-profit organisation at the time of application and for the entire duration of the proposed Public Engagement project.
- Applicants would need to ensure they have sufficient expertise to devise and implement the project or ensure they have suitable collaborators who will be contributing appropriately to the project. For e.g, if you are not a researcher, include a science researcher (s) or subject expert in the area of the proposal or a health professional in your team.

Support

INR 50,000 - 10 Lakhs

The budget requested can include the following:

- Personnel costs directly related to the project
- Direct activity and production costs of any materials to be used (renting equipment, venue etc.)
- Project travel, publicity, and administration costs

Duration

The duration of the grant is 1-12 Months.

Deadline

The applications are open throughout the year.

Website

<https://www.indiaalliance.org/public-engagement>

7.1.4. KARYASHALA (High - End Workshops) | Accelerate Vigyan

'KARYASHALA' is aimed to provide hands-on experience to students primarily from universities, colleges, private academic institutions, and newly established institutes in handling/ troubleshooting high-end scientific instruments and such skill development on themes required for research work.

Eligibility

- Faculty or scientists working in central institutions of higher learning and research such as IITs, IISc, IISERs, NITs, and other institutions and laboratories of eminence like CSIR, ICAR, ICMR, etc.
- The proposals may be submitted on the established areas of science and engineering fields available in the Institute. However, SERB may also invite proposals for 'KARYASHALA' from the institutes on a special call based on identified thrust areas.
- Institute should devise a well-defined shortlisting criterion for the selection of candidates based on the basic eligibility criteria laid out by SERB and as per formulated guidelines for the specific workshop. You can find more details here - [कार्यशाला \(High - End Workshops\), Karyashala](#).

Suggested Topics: Written & Oral Effective Science Communication

- Benefits and Challenges
- Prepare concise and logically-written materials
- Organise and communicate ideas effectively in oral presentations
- Techniques — brief abstract to a book-length manuscript
- Communicating Scientific Information to the Public
- Write effective grant proposals & Reports

Deadline

Applications can generally be submitted through the Accelerate Vigyan web portal in May for the winter season (November - January) and in November for the summer season (May - July) of the following year.

Website

<https://acceleratevigyan.gov.in/programs/abhyas/karyashala>

Grants for Science Outreach (International)



7.2.1. Science Outreach and Communication Grant | American Society for Biochemistry and Molecular Biology

The American Society for Biochemistry and Molecular Biology (ASBMB) aims to increase public appreciation for and understanding of science by promoting science outreach events that encourage interactions between scientists and the community. The member-wide outreach award facilitates the involvement of ASBMB members in public-engagement activities that foster the appreciation of science — particularly **biochemistry and molecular biology** — in informal settings.

The society welcomes applications for a variety of outreach activities, including proposals for in-person, hybrid or fully virtual programming. These might include talks, webinars, workshops, demonstrations, activities at science cafés/ festivals/ fairs/ clubs, class visits to biochemistry laboratories to carry out experiments, activities/resources for K–12 students, etc. They look for creative ideas from applicants that take into consideration accessibility and reach. Audiences from different backgrounds, particularly those that are underrepresented in science careers, are encouraged.

Eligibility

- The primary applicant must be an ASBMB member at the time of the application and during the period of the proposed activity.
- Although projects need not be limited to the science of biochemistry and molecular biology, the ASBMB strongly encourages activities that promote the understanding of the molecular nature of life.

Support

Up to five grants of at most \$1,000 each

Duration

The funds must be used within six months from the date of receipt of funds.

Deadline

The application opens once a year.

Website

<https://www.asbmb.org/education/science-outreach/science-outreach-and-communication-grant>

7.2.2. Scientific Outreach Grants | Biochemical Society

The Biochemical Society supports public engagement and outreach activities that communicate the excitement of **molecular bioscience** to young people and the community. The outreach grants aim to increase participation in molecular biosciences at the school level and beyond through engaging activities.

The types of projects that could be run with funding of up to £1000 include:

- Re-using established activities/resources in a new context or with a new perspective.
- Development of a new activity or resource for participants.
- Inspiring workshops or lectures for students, teachers or communities.
- Development of online content or activities that could be used to engage communities.
- Community-led activities based on your research interests.

The types of activities that could be funded with up to £5000 of grant funding include:

- Development of a new activity or resource for groups of participants for sustained use.
- Series of workshops or lectures for students, teachers or communities that involve continued engagement with participants.
- Development of a new or expansion of an established engagement event, such as a science or community festival.

- Sustained community-led activities or engagement based on your research interests that will continue to engage the desired communities or groups.

Support

The grant awards up to £1000 and up to £5000 depending on the category.

Deadline

The applications will close on 9 October 2023 for this year. Please check the website for deadline.

Website

<https://www.biochemistry.org/grants-and-awards/grants-and-bursaries/scientific-outreach-grants/>

7.2.3. Outreach Grants | British Ecological Society

The British Ecological Society (BES) aims to support applications that promote and engage the public understanding of the **science of ecology**, to stimulate discussion about ecology and its implications for society, to inspire and enthuse people of all ages about the science of ecology, especially those not previously interested and develop skills in communicating the science of ecology.

Eligibility

It is open to BES members and teams and organisations with a BES member leading the application.

Support

This grant provides up to £2,000 to individuals, teams and organisations to deliver outreach and engagement activities.

Deadline

The applications generally open in July and close in August. Please check the website for the deadline.

Website

<https://www.britishecologicalsociety.org/funding/outreach-grants/>
<https://www.britishecologicalsociety.org/funding/launching-our-new-grants-programme/outreach-and-engagement-grants/>

Note: BES will be launching a new grants programme in 2024 that will be distinctive, further careers and support the entire ecological community. The existing grants will continue in their current form until the end of 2023.

7.2.4. Outreach Grant | Society for Experimental Biology

The Society for Experimental Biology (SEB) aims to empower its members to contribute to the public understanding of science and to promote engagement in **experimental biology**. The Outreach Grant provides funding to support outreach and public engagement events and activities that will reach a variety of public audiences by stimulating interest and discussion around the importance of experimental biology and its implications for society.

Eligibility

- Outreach and public engagement grants are available to both SEB members and non-members who are part of the science community and wish to contribute to the public understanding of experimental biology.
- The scientific topic of the event or activity must be within SEB's scientific remit (animal, plant or cell biology) and aim to increase understanding of and engagement with experimental biology.
- Preference is given to proposals that result in a resource or tool that can be hosted on the SEB website for use by other members or that can be used to reach under-served groups and communities.

Support

- SEB members can apply for a maximum of £1000.
- SEB non-members can apply for a maximum of £200.

Deadline

The applications open twice a year, on the 1st of June and the 1st of October.

Website

<https://www.sebiology.org/submissions-grant/outreach-grant-2023.html>

7.2.5. Sharing Science Grants | Advancing Earth and Space Sciences

Advancing Earth and Space Sciences (AGU), through Sharing Science Grants tries to help fuel creative public-engagement endeavours.

Eligibility

This grant supports scientists around the world to encourage and jump-start outreach and engagement activities that will share science and its value with wider communities, from journalists to policymakers to students to members of the public.

Support

The grant awards up to \$1,000 or less.

Duration

The duration of the award is 1 year.

Deadline

Please check the website for the deadline.

Website

<https://www.agu.org/Share-and-Advocate/Share/Sharing-science-network/Sharing-Science-Grants>

7.2.6. COMPASS Outreach Grants | American Society for Cell Biology

The American Society for Cell Biology (ASCB) members can apply for this grant to promote science outreach projects such as student lab visits, science fairs, or other ideas for engaging the public.

Eligibility

The grant is open to active ASCB members with priority given to student and postdoc members.

Support

The ASCB members can apply for a grant of **\$1,000**.

Deadline

Please check the website for the deadline.

Website

<https://www.ascb.org/grants-awards/compass-outreach-grants/>

7.2.7. Outreach and Engagement Grants | Royal Society of Biology

The Royal Society of Biology (RSB) offers outreach and engagement grants for members to run an outreach or engagement event or activity that are creative, impactful, and suited for audiences or based in locations that may have otherwise limited opportunities to engage with **bioscience** topics or concepts.

Eligibility

The lead applicant must be a member of RSB and responsible for the delivery of the grant-funded activity or event taking place.

Support

In each funding round, they have three funding categories, with the total funds available being split between these as deemed appropriate:

- **Small Grant** - Grants of up to £200, intended for smaller events and activities, such as a one-off event or activity, or the final injection of funding required to make an event or activity possible.
- **Full Grant** - between £201 - £500 for a single event or activity, or a series of events or activities that requires a greater amount of funding.

- **Higher Full Grant** - between £501 - £1,000 for a single event or activity, or a series of events or activities that requires a greater amount of funding.

Deadline

The application opens once a year. Please check the website for the deadline.

Website

<https://www.rsb.org.uk/get-involved/grants/outreach-grants>

Manjula Harikrishna
IndiaBioscience



A COLLECTION OF RESOURCES,
ORGANISATIONS AND IDEAS
FOR SCIENCE OUTREACH
A COMPILATION BY KARISHMA S KAUSHIK

Resources, organisations and ideas for science outreach



We have collated a list of resources to encourage life scientists to build impactful science outreach ideas that reflect passion, creativity and impact to broader society. Further, these ideas will encourage outreach to be catered to a wide range of stakeholders such as underserved communities and peripheral parts of the country.

Science outreach for health

- Cartoons and infographics on topics of relevance to health — including less-addressed areas such as mental health, genetic disorders, malnutrition, childhood obesity, etc.
- Support groups for disease awareness, information, advocacy, de-stigmatisation, including but not limited to rare diseases, mental health, genetic disorders, etc.

Science outreach for national and global challenges

- Building resources and tools for awareness and solutions towards Sustainable Development Goals (SDGs).
- Facilitating local communities to take part in crowd-sourced scientific projects, including conservation, biodiversity, sustainable climate change solutions, etc.

Science outreach for rural and tribal communities

- In-person discussions and/or resource materials in local and regional languages on scientific issues and solutions, and combating scientific misinformation in rural and tribal communities.
- Showcasing the value of science education to members of rural and tribal communities.
- Information on science careers for students and young adults in rural and tribal communities.

Science outreach to facilitate the scientific and research community

- Re-invent networking for scientists using digital platforms.
- Ideas to improve diversity, inclusion, and equity in scientific communities, with a focus on enhancing visibility of underserved groups and communities.
- Improved local and open sharing of scientific ideas and resources across the scientific community.

Additional reading:

A Faculty-Led, Community-Building Program That Enhances Student-Faculty Connections within Biology (2022).

Open Chemistry: What if we just give everything away? (2021).

Science outreach for the documentation of science

- Innovative approaches to showcase achievements in Indian science and their role in nation building (exhibits, posters, online interactive platforms, virtual museums).
- Approaches to highlight the history of science – stories behind specific discoveries and how they were made, etc.
- Materials or approaches to highlight the roles and contributions of under-represented or under-served individuals or communities in science.

Science outreach events

- One-day science fairs or festivals conducted for school and college students, curious adults, public at large.
- Short in-person demonstrations, tinkering labs, hands-on activities for school and college students, curious adults, public at large.

Additional reading:

STEM Outreach Using In-House and Mobile Demonstrations (2018).

Science outreach for K-12 students

- Explainer science websites, videos and virtual labs for school students and curious adults.

- Engaging the public with at-home experiments – output could be in the form of a short movie or a popular book.
- Setting up e-colouring books for primary school students with basic life science concepts.
- Hosting regular podcasts or webinars or discuss/share relevant scientific principles and advances.
- Interactive in-person or virtual sessions for the public to interact with scientists etc.

Additional reading:

A pedagogical approach to science outreach (2020)

Science Outreach: Six Examples of Programs that Enrich the Learning Environments of Students and Educators (2020)

Joyful Microbe (Accessed in March 2023)

IndiaAsksWhy: A Science Podcast for Young Minds! (Accessed in March 2023)

Brains On! Universe (Accessed in March 2023)

Talk To A Scientist (Accessed in March 2023)

HANDS-ON SCIENCE E-BOOK, Talk To A Scientist (Accessed in March 2023)

Science Educational Outreach Programs That Benefit Students and Scientists (2016)

I'm a Scientist (Accessed in March 2023)

Skype a Scientist (Accessed in March 2023)

Science outreach for adults and special groups

- Approaches to counter scientific misinformation, myths, superstitions in society, using popular tools such as Whatsapp.
- Fun science outreach for retired age groups, ex-service personnel, alumni associations, with in-person scientist talks (science behind cheese-making, science of idlis, science behind hand sanitizer).
- Scientist-led day trips to local science incubation parks to observe product-driven scientific research, etc.
- Science materials for persons with special needs, using materials with tactile, auditory and visual modifications for engagement.

Additional reading:

A touch of space weather! An EGU funded outreach project for blind and visually impaired students (2023)

The making of project RAKSHA: Reach and Advocacy for Autistic Kids' Sexual Health and Safety Attitudes (2023)

Science outreach via unique approaches

- Public engagement of science via unique approaches such as art, music, dance, theatre, stand-up comedy, poetry, street plays, memes, photography, handicrafts, etc.
- Lord of the Rings – quoting performance wins this year’s ‘Dance Your Ph.D.’ contest (2023).
- Talk with teachers: Blurring boundaries between arts and sciences (2022).

Additional reading

Making Science Outreach Inclusive: Beyond Standard Paradigms (2020).

Science Outreach Is Great but Scientists Must Consider Who They’re Reaching (2018).

Karishma S Kaushik

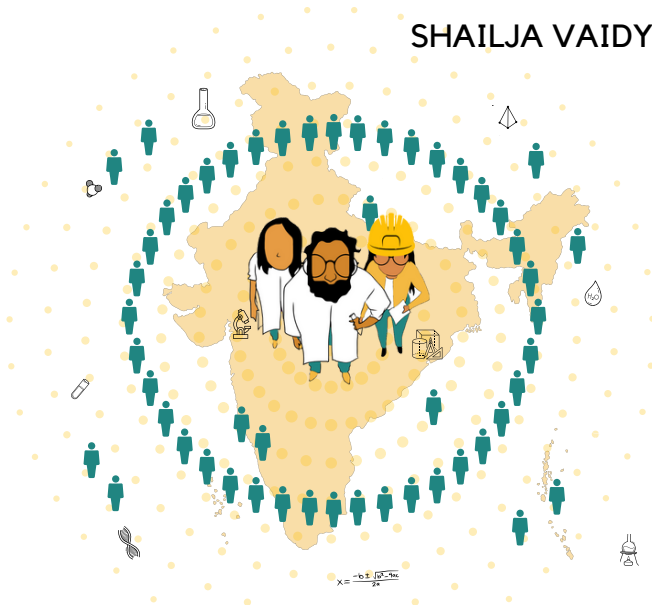
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SCIENCE OUTREACH AS A
TOOL FOR NATION BUILDING

Science outreach as a tool for nation building

SHAILJA VAIDYA GUPTA



Scientific enquiry is enshrined in the Indian Constitution. The 42nd amendment 1976, Article 51 A(h) states under Fundamental Duties that it shall be the duty of every citizen of India, “*To develop scientific temper, humanism and the spirit of enquiry and reform*”. India is, perhaps, the only country where developing scientific temper is a fundamental duty of every citizen and the magnitude of this responsibility for a scientist is manifold.

Science is the fulcrum of the very existence of life. Science impacts life in all its forms — from ease of living to longevity of living and sustainable coexistence of flora and fauna on water and land. When science is ignored or neglected, perils of anthropogenic activity become dominant.

In a megadiverse, complex country like India, with multiple languages of communication, cultural beliefs, and socio-economic systems, the criticality of science outreach cannot be overstated. Building scientific temper, science communication, or science outreach has been a topic of much debate and discussion in India since its independence. In this gem of a paper, ‘[A Perspective on Scientific Temper in India](#)’, Subodh Mahanti, Scientist, Vigyan Prasar, captures much of the debate and discussions from post-independence to the present day.

For decades, the best scientific minds leveraged science communication towards building the “scientific temper” of the nation, ostensibly to fight deep-rooted superstitious beliefs and practices, but truly as a powerful tool for building a modern and progressive India.

The Scientific Policy Resolution in 1958, the 42nd Constitutional Amendment in 1976, the issuance of the Bombay Statement of Scientific Temper in 1981, which was countered by many, mainly the Madras group of Patriotic People for Science and Technology (PPST), and the setting up of the National Council of Scientific and Technology Communication (NCSTC) in 2002, remind us that much of what is being debated today has been discussed over decades. Left and Right political ideology has always influenced science's most powerful voices. Lessons need to be learned from historic and institutional perspective to not keep repeating the same mistakes over and over again.

The exclusiveness of the elite scientific groups and the exclusion of the commoner view, ethos, and sociocultural structure and beliefs have been major stumbling blocks. The Bombay Statement for Scientific Temper, issued by PN Haksar, Raja Ramanna, and PM Bhargava and signed by who's who of the science of that time, was definitely lecturing from ivory towers. The piece was criticised as rhetoric, and in retrospect, appearing to talk down to people, was not the best form of science communication. The need for balanced scientific communication free from ideology, and empathetic for sociocultural beliefs is imperative and, in present times, critical. Honest and straightforward communication is the key.

The language of science between the scientist and the common audience needs to evolve into a form of communication where both are understood, and the impact of science effectively demonstrated.

For successful science outreach the following principles may be considered:

1. Simple communication: The office of the Principal Scientific Adviser (PSA) to the Government of India issued many advisories during the pandemic. The reason for the success of the adoption of these advisories, from the use of homemade masks, and homecare tips for managing COVID-19 infection to the use of proper ventilation, was the fact that science was communicated and illustrated simply using local language, while addressing a wide spectrum of geography and sociocultural mass. The advisories were made available in 16 major Indian languages. Access to information in a language understood by the general population is crucial for the information to have an impact. The mask advisory was also translated and used by many, including Nepal (a Nepalese translation is available). The illustrations of the homecare advisory were used by the Calvary Public Hospital Bruce in Canberra, Australia.

2. Democratise science: Science is an elitist pursuit, and education in science is more expensive than any other. "Science is not in the lab. It is wherever you are; it is all around us. Right under our noses are thousands of phenomena that no one understands," said Manu Prakash, Associate Professor, Stanford University, who invented the Foldscope along with Jim Cybulski. Foldscope leads the process of democratisation of and access to science, with cheap and easy-to-use scientific tools made available to the most resource-constrained schools, colleges, and labs across the world. Foldscope was brought to India by the Department of Biotechnology (DBT), Government of India, and Prakash Lab, Stanford University, and spread across India through a microgrant along with foldscopes to 500 plus government schools and colleges. Microgrants are effective means of science outreach, as one school teacher from a government school in Tamil Nadu remarked that this microgrant was the first grant he got from the central government, as the application form in English was simple, and he could fill it out with the help of an English speaking colleague. Outreach in regional languages in India cannot be emphasised enough.

The Nobel Prize Series was initiated with the aim of making the best of science more inclusive and equitable. DBT brought together 1000 teachers and 2000 students from government schools, including Kendriya Vidyalaya, Navodaya Vidyalaya from across India, to attend the Nobel Prize Series, India 2018, and to interact with the five Nobel Laureates who graced the Nobel Prize Series – the highlight of the event was the interaction of the students and teachers with the laureates.

The incident which remains the hallmark of this event is of a school teacher from a government school, Andaman and Nicobar Island, stating that this was the first time he heard the phrase "curiosity-driven science". That India is a complex paradox was evident, and reaching the most unreached, making science egalitarian is our fundamental duty.

3. Evidence-based science structuring: Just as science provides evidence for policy, it is equally important for scientists to comprehend the scientific needs of the population, whether it's the local farmer, healthcare worker, or conservationist. Empowering them with scientific tools is the responsibility of scientists. Structuring science to the needs of the nation must be the basic tenet.

4. High-quality documentation and data visualisation: The other side of science outreach is positioning the nation's science and technology with high-quality documentation and data presentation, conveying the impact of Indian science over the years, communicating the global competitiveness of Indian science and its

contribution to the economic growth of the country. These documents are extremely important while negotiating with the government for increased investment in science.

The reach of science communication and outreach is vast and varied. India needs powerful and coherent voices which communicate the importance of science with clarity and honesty to multiple stakeholders. The Indian population trusts Indian scientists, as demonstrated by the almost complete lack of vaccine hesitancy when various vaccines were introduced during the pandemic or the enthusiastic support to Indian Space Research Organisation's (ISRO) many space endeavours. Amongst many examples, scientists must not betray their faith and trust, they must continue to convey to the people the benefits of science – it is a fundamental duty and responsibility.

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$$F = \frac{Gm_1m_2}{r^2}$$

$$\sum \tau = \frac{dW}{dt}$$



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