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Pseudoscience and the Pandemic

The world is reeling from a deadly pandemic, but the spread of pseudoscience has proven to be far more contagious and deadly than COVID-19 itself. When people with great political power and social influence propagate pseudoscience, the situation worsens beyond our wildest imagination.

It's not uncommon to see influencers claiming and marketing products as 'cures' for the viral infection. Recovery is falsely being attributed to such pseudoscientific 'cures' and thus is misleading many people, as the recovery rate from the condition is pretty high. This, in turn, creates a false sense of security and discourages people from approaching doctors when symptoms appear. There have been cases where such self-treatments have turned catastrophic and have also affected a larger number of people. It has become a matter of pride for people to market traditional medicines with little or no scientific evidence as a mark of self-reliance. We have witnessed homeopathic medicines being distributed as a preventive measure for the viral infection at the beginning of the pandemic. Political leaders of a few developed countries have made many controversial pseudoscientific statements and have disregarded preventive measures like lockdowns, social distancing, etc. It's no wonder that these countries have witnessed an exponential increase in COVID-19 cases in a short time. There have been instances where religious leaders have propagated pseudoscience by appealing to people's sentiments and have consequently accelerated the spread of the disease. Pseudoscience, wrapped in the blanket of religion and jingoism, is being marketed wisely to the anxious masses and thus is aggravating the situation.

There is also a sudden surge in the number of social-media influencers giving medical advice. Gullible people take medications without a registered medical practitioner's prescription and end up with other medical conditions, pressurising the already burdened healthcare system. Immunity-boosting diet, COVID-19 preventing food products and predictions about the end of the pandemic are flooding people's timelines. Most such claims have proven to be nothing but cheap advertisements.

The worst of all is the idea that COVID-19 is a hoax. Circulating this idea has led to people disregarding the mandatory precautions, thus paving the way for furthering the virus's spread.

In addition to all this, xenophobia is at an all-time high due to misinformation as the spread is attributed to a particular group of people.

Pseudoscience gives people a false sense of security and discourages them from taking the necessary precautions. We must fact-check information before processing it and also stop forwarding such pseudoscientific ideas. It has been proven that scientific evidence, however meagre, is the only right way to approach the pandemic.

—J.Vishwathiga, B'19
Sources: [1], [2]

Interview with Dr Mohit Kumar Jolly

Earlier this month, Anvesha had the opportunity to interview Dr Mohit Kumar Jolly, Assistant Professor at the Centre for BioSystems, Science and Engineering, IISc Bangalore. Dr Jolly is a co-founder of IIT Kanpur's science magazine, and continues to participate in the field of science-communication by training others in the field. He is also an associate faculty at the Centre for Science and Policy, IISc. Anvesha had the pleasure of hosting Dr Jolly for a talk on science-communication back in February of this year, which was a grand event that was very well received by the participants. The interview was conducted by Shreya Venkatesan (SV) and Akshita Mittal (AM) from BS-MS Batch '19. The interview was transcribed by SV, AM, and Balaram Vishnu Subramani from BS-MS Batch '17. The following is the transcript of the interview:

SV: Could you start by taking us through your professional life and how you forayed into science communication?

MKJ: My foray into science communication was as an undergrad student in 2008 when I started the campus science magazine of IIT Kanpur called *NERD*, an acronym for *Notes on Engineering and Research Development*. When we started, the overall idea was to provide a platform for students on campus to share with a wider audience their research, summer projects, science club projects, basically anything that interested them in science. At least at that time, I did not think that that opportunity was widely available. I am sure as you have seen, for various reasons in undergraduate colleges, some clubs get more so-called publicity or glamour associated with them; usually, they don't happen to be the science clubs. To be honest, I was not a science geek either. I was more interested in journalism, but I realized that science journalism was something that was very much lacking. That's how we got started; we approached the then Dean of Research and Development (of IIT Kanpur), Prof. Muralidhar. He was extremely supportive of the idea of a student-run science magazine. We then invited articles from undergraduate as well as postgraduate students across the campus. They submitted all kinds of articles focused on whatever they were interested in. To give it more of a magazine flavour than a journal flavour, we had interviews with eminent scientists, faculty members who were very well known for their teaching, etc. I was the co-Chief Editor of NERD for almost three years and moved on to start a lecture series called *SCOPE (Science Communication and Public Engagement)*. We invited various science journalists, communicators, educators, etc., to come to campus, share their experiences and tell us what science communication and the field was all about. I was extremely fortunate that in those couple of years, there were good conferences in India by international professional societies in the area of science communication, one of those being the Public Communication of Science and Technology community. They had their annual meeting in India, which had created quite a bit of enthusiasm.

At some point, I was considering a PhD in science communication, but I realised that it was a good hobby and I would continue to do it. I had gotten interested in something in science at that point of time that I could think about committing the next five years to. So I decided to do a PhD in *regular* science, not in science communication per se. I went to Rice University, Houston, Texas and the *keeda [itch]* of science communication didn't go away. I participated in 90-second thesis competitions there, got a couple of awards and then trained students who won those awards later. I started the science communication conference [*ComSciCon*] local chapter in Houston in 2017. For two years, I also served as a consultant at the Centre for Written, Oral and Visual Communication, helping PhD students, undergrads and postdocs by giving them feedback on their research articles, abstracts, posters, videos, etc. from a professional communication perspective. Thus, my focus gradually moved to training students in science communication. I think it's an extremely important component, even more so today. Now, at IISc, in addition to my position at the Centre for Biosystems Science and Engineering, I am an associate faculty at Centre for Society and Policy, where my interests mostly lie in exploring opportunities to train students in science communication, to expose them to what, broadly speaking, the science and society framework looks like. I enjoy teaching science communication equally, if not more, than I enjoy teaching my subject because there is a lot more involvement when you do theatre exercises with students and put them in uncomfortable positions so that they are forced to communicate. They realise that this is an important skill for them as scientists and for whatever career they might pursue after their education in their particular subject.

AM: How would you encourage early-career researchers and students to develop an interest in science communication? How should they go about pursuing it?

MKJ: I think this time is fantastic to do and practise science communication. I'm sure you all get WhatsApp messages about COVID, what can and cannot treat COVID, etc. You know all these pseudoscientific or non-scientific ideas are floated around using the

most modern technology we have. That's the irony of the situation. When you get such messages, many of you are probably consulted by family members on your expert opinion as a scientist. As I said, there cannot be a better time for you to practice science communication, to realise the importance of this when it can really affect the lives of your family members. If they are not listening to wearing masks or taking other protections, this is the time you emphatically tell them, "Look, you may have your opinion, but for the safety of everyone in the family, it is important that you follow these precautions for some time." I've realised, and various other *gurus* in science communication have mentioned that when you talk about science communication, it's more about communication than about science. You cannot contest opinions with facts. It just does not work. So you have to adopt a different framework where you are not constantly saying numbers or other things that don't necessarily make sense to your audience. Try to understand where they are coming from and find common ground somewhere in between. Scientific thinking, scientific temper, critical thinking, etc., are built over time. They are not a 2-minute Maggi noodles pack, which you can make right away. Debunk unscientific statements or theories based on what you know to be true from scientific literature on COVID and other infectious diseases. Take up the opportunity and enjoy the process. Many times, life puts us in situations which we are not prepared for. COVID is undoubtedly one of them. I would say that science communication during COVID is another one. Making a mark now, even at a local level, is an excellent start.

SV: We aren't alien to the public being misled into believing wrong scientific data or everything they see on social media. How can fact-checking and critical analysis of news/media content be encouraged? According to you, what is the best way to stop/mitigate the spread of fake news?

MKJ: I wish I had an answer to that question. Three weeks ago, I was at the Society of Mathematical Biology's annual meeting, which was held completely online. The closing keynote lecture was by Carl Bergstrom. He has been debunking a lot of misleading news stories related to COVID. Say, for instance, if you don't present the labels of the y-axis of a graph properly, it can mean completely different things. You could plot two things simultaneously, but a difference in the orders of magnitude of the axes would mislead people, intentionally or unintentionally. I would say that one should consider this as a fantastic training for oneself; 'Can I see through this?' or 'Can I try to convince my local vicinity?' Since most of you are at home, this is the most unadulterated time you will get in your local vicinity. This (public being misled) is not a problem specific to this century. The overall idea of many beliefs which are not necessarily embedded in deep scientific knowledge (which can change later of course, as science is an evolving picture in itself) has been around and has been plaguing different parts of our society. It comes in different manifestations. If you look in the US, 'vaccines causing autism' is a strong belief in various parts. Now, the same people, when you talk of a COVID vaccine, they say, 'Yes, but for COVID we need a vaccine.' These are the scenarios that exist all around, so try to understand where they're coming from. Our goal is not to educate them about science. 'One mole of molecules means the Avogadro number'—that's not the goal. The goal is not numbers or to shove facts down anyone's throat. The goal is to present an alternative hypothesis, and as I said, it's more about communication than science. So you say, 'Well sure, I get your point. Let me present an alternate scenario.' Then you slowly try to explain your argument. It's like two points on a Euclidean map. The farther they are, the more time it will take to cross that distance. These two points are perspectives. You have to estimate the distance first, and then you have to estimate the rate at which you can begin to make progress and therefore, this is the time that you will take assuming that there is no influence coming on the other side (which, of course, is a false assumption), so that you will be able to meet them somewhere midway. Suppose you think that you will convey everything in the first interaction, and they should take your word for it because you are a science student—in science communication literature, this is called a 'deficit model' because you are of the assumption *aham brahmasmi [I am Brahma]*, meaning 'I know everything, and my only job is to pour the fountain of knowledge into empty vessels,' which is not true. That is something that you should not do. Don't think from that mindset.

I ask one question to all participants in science communication workshops, 'What activities come to mind when you think of communication?' Often, I get the answers as speaking and writing, very rarely do people say reading and listening, which is an equal, if not a more important, part of any form of communication. If you are just bent on sending a message without realising how much of it you were able to convey, you will not make any progress. In fact, you are going to make anti-progress in the sense that you will alienate yourself because they [the audience] form the opinion that you don't listen, so there is no use in talking to you. Get out of that *aham brahmasmi* mode, get into a communicative mode and realise where other people are coming from. Of course, you will fail multiple times, but that's okay. That's how we learn.

AM: When addressing an audience, either through written, oral or visual media, we take into consideration the pre-existing knowledge of the audience about the topic at hand. If you had a mixed audience, how would you keep it simple enough for newcomers to the field yet interesting enough for seasoned professionals? In such a case, would you prioritize the interests of one of them at the expense of the other? What would be a good set of guidelines to follow?

MKJ: Even within a so-called scientific audience, the meaning of a word can differ from discipline to discipline. Take the example of the word 'differentiation'. To a biologist and a mathematician, they mean completely different things. Even with the word 'translation'. Is it central dogma translation from biology or is it linguistic translation? You have to sense the diversity of the audience and where they're coming from. Try to pitch things in a story format, like an informal conversation. I always tell my students, "Don't show me the next graph. First write down what questions you are posing that the next graph will answer." In a movie or a story, it's always about what happens next. That is what keeps an audience glued in some sense. I'm sure you would've seen various Bollywood movies, and I don't want to stereotype them. But we all knew that Raj and Simran [from DDLJ] would get married eventually; there was no doubt about it. We were still engaged because we were constantly wondering what would happen next. How does the villain finally

get defeated? Following that strategy takes quite a bit of time. That helps you catch their attention and sustain it. In storytelling literature, the idea is that good storytellers first engage the audience, arouse their interest, and then fulfil their interest. We, as scientists, fulfil and fulfil. We don't necessarily feel that it is our responsibility to arouse their interest. One of the major reasons is that we already have a so-called pre-aroused audience when we go to conferences, seminars, etc. People there already have at least a bare minimum amount of interest. Get out of that framework and see what exactly the audience is responsive to. That's why any talk you prepare for, don't worry about the content first, worry about the audience and their composition. Then you can think about the message you will be conveying, be it a scientific talk or a popular-science talk. The principles of communication are the same. Based on that, decide how to move forward.

SV: Many undergraduate students, especially in their first year, have a mental block when it comes to reading research papers, mostly because of the number of terms that seem incomprehensible. What practical advice would you offer them to overcome that fear?

MKJ: Here is where I think the advantage of being in an environment where you have people pursuing majors in different disciplines comes. Let's say you're from a physics background and you're interested in some concepts of basic fluid mechanics, very generally speaking. If someone tells you to read about 'Life At Low Reynolds Number' type of article, you will find popular science articles which tell you about how biological organisms survive in that hypothetical set-up. Those are good starting places. Instead of going straight away to research articles, if one is slowly led to these semi-popular articles which try to tell them that nature did not create the distinct disciplines in science (PCMB), our school curriculum did. When various systems in nature operate, they embody principles across these different disciplines that we have devised for our attempts to understand (or claim to understand) nature better. If there are articles that connect those dots, students are exposed to a larger variety of questions. Albeit, the questions are what get people excited, be it in a story or be it curiosity by research. Some research related to that topic (which there is plenty now on the internet) might be a better starting point. From there, you can go to review articles which don't go into all the details right away. You can find connections between mathematics and biology. Your high school education will tell you that there is none. So, if you are exposed to such literature, it might act as a good stepping stone.

AM: Apart from science journalism, how do you think science can be made more accessible to an average college student as well as the public? What is your opinion of paid research resources, especially scientific papers?

MKJ: As far as the second question is concerned, this is the scientific publishing ecosystem, where the money that the publishers make, either comes from subscriptions from individuals or institutes to corresponding journals. An alternate mode that publishers are adopting these days is open-access research, where there are no subscriptions, but the authors have to pay for it. Which model is better and which is not? I am afraid I don't know enough about it.

Various journals have adopted a hybrid open-access strategy where after a year or so, journals put up their publications in the public domain so that everyone can access them for free.

Now, how to make science more accessible? Again, the first question that comes to mind is the clarity of purpose. It is essential, but it is essential for various reasons. What is your reason? As an individual, if you are trying to make science more accessible, is your reason to excite college students? This is the most common reason that at least I have seen and heard about. As you may be aware, there is now a Scientific Social Responsibility document out, which, from what I understand, is similar to the mechanism as in National Science Foundation in the US, where a part of the budget is mandated for some activity of scientific outreach and training. I think there are multiple opportunities these days. There are more and more competitions coming along these lines, both at national and international level. For instance, the Department of Science and Technology (DST) has recently started a competition called AWSAR, where one has to write about their research, and there is good prize money associated with it. Similarly, India BioScience has rolled out some grants for doing more science outreach. There are more and more initiatives coming. One of the reasons why not many *active* scientists have involved themselves in science communication is because there's no incentive for doing so. I've read in public news reports, so I can't attest to the credibility of this, but if you go back to the 1990s, Carl Sagan was denied some senior positions and honours because people thought, "Oh, this person is doing science communication, so he must not be good at science." Science communication is seen as an exit option for those who are not making breakthrough discoveries. This mentality has to change. More and more positive reinforcement and incentives is needed for both students and faculty members. Since taxpayers' money is funding research, they have the responsibility to know about it. It [sci-comm] is required in all manifestations, because science cannot exist without society, for obvious reasons. It is a part of the ecosystem and landscape. So, decide your mode, your purpose, your audience, and then do it.

SV: Following the previous question, what do you think about English being a necessity in communication among academics and its role in the exclusion of researchers and students alike from important discussions? How do you think language barriers can be overcome in academia?

MKJ: My PhD advisor used to say that broken English is the international language of science. The way I interpreted it was that not everyone is a native speaker, and not everyone is expected to be a native speaker. We should welcome students from all different backgrounds, including language as a criterion, to involve them as much as possible. In the globalised world, will you be able to survive without English in higher levels of academics such as graduate school? I am not sure. Having said that, I see research papers written, even until today, in Mandarin, Russian etc. Do we see that in India? I have not seen that on the internet, but that doesn't mean it does not exist. So, yes, language can be thought of as a barrier. Once you learn some of the concepts in a particular language, you are always translating in your head when exposed to a different language. To things like that, my humble submission is that the solutions are better if they are bottom-up rather than top-down. If someone is facing issues in following English, find a person or a group of people who is adept at both the language you're comfortable in, English. Then try to use that resource as a bridge to overcome some of the initial aspects. The other thing that happens, at least what I've seen in our country, is that somehow the student's confidence becomes directly proportional to their fluency in English. To me, this attitude makes very little sense. To me, this attitude makes very little sense. When I talk of communication, it is a language-independent phenomenon. Communication skills do not mean perfect grammar according to *Wren and Martin*. Communication skills refer to your ability to convey the message to the audience effectively such that whatever image you have of that concept, of that idea, you create a similar image, a mental map in the other person's mind. Again, if you utter the word 'differentiation', it can have two different images in the mind of a mathematician and a biologist. Using the same word, which is in English language, but still not necessarily able to fulfil the communication aspects. Perhaps local support groups in colleges, at other places, are probably a better way to get immediate help. If one is motivated, one can at least try to overcome the minimum energy barrier in their vicinity and hope that this would provide an example for others to follow.

AM: You talked about how students and scientists can play their part in science communication. What is the role of institutions in sci-comm? How can they do their bit to spread science to those who cannot access it easily?

MKJ: Institutions are, at the end of the day, a conglomerate of individuals, so definitely they also have a role in trying to do this. For instance, I know IISc does an open day once a year, where I'm told there is a participation of at least 50,000 people. School students in and around Bangalore are present, and I'm sure others can also come if they're interested. It contains a variety of exhibits, and it is almost an 8–10 hour event That is one mode, where you can conduct big events. Are there other ways in which this can be done? Yes, one visits different schools or colleges in

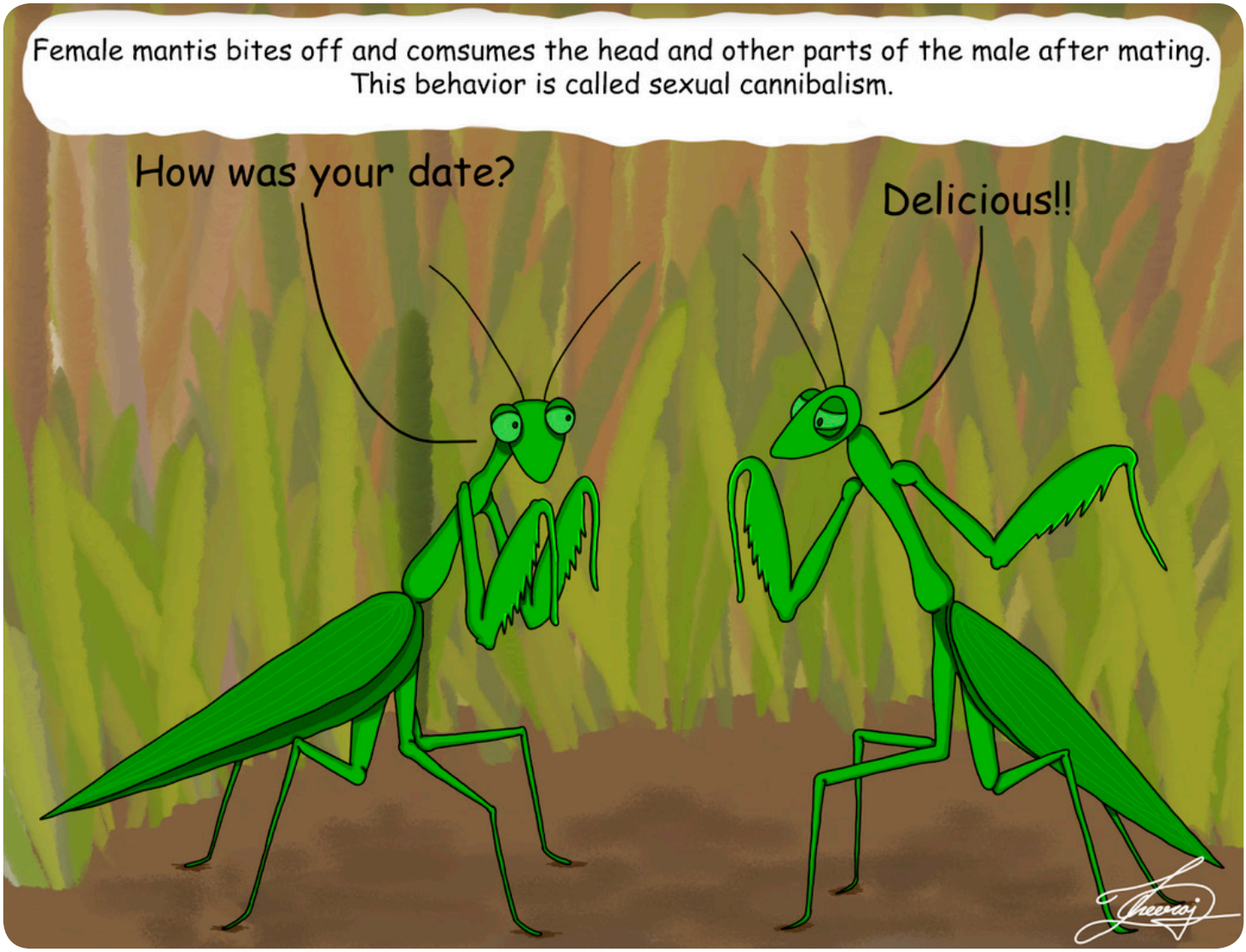
smaller crowds or has visits from lab students, not in such massive numbers such that students don't necessarily get the individual attention. But then again, perhaps departments can do additional smaller scale open-days or similar activities. Institutions can play an extremely supportive role, but again, my humble submission is that bottom-up approaches are more long-lived, and bottom-up approaches select for those who are genuinely interested in that cause. You can't really force these things down one's throat.

SV: Those were all of our questions. Thank you so much for your time

MKJ: Thank you very much for the opportunity!

Eat Prey Love

—C. L. Dheeraj, B '17



The Things I've Learnt in the Past Year: A Wrap Up

As we draw up on the one year anniversary of Exhibit A, I thought it would be fitting to look back on the 12 months that have gone by. I joined the team as an overenthusiastic first-year who knew nothing about science journalism. With each passing edition, our team explored new ideas, argued with each other, stumbled, experimented, and ultimately got better. I learnt more than I had anticipated, and it has been a rewarding experience to write for Anvesha. Here are some of the things I learnt along the way:

The devil is in the details

When communicating the results of scientific enquiry with the public, it is tempting to forgo certain details in order to preserve simplicity. However, this sometimes causes people to draw incorrect conclusions or misinterpret results. Popular science articles will talk about new discoveries or studies without mentioning their shortcomings, criticisms or anything else that may question the credibility of the data. This is dangerous because even if the original scientific literature with these criticisms is linked and cited, your average reader is unlikely to read it or have the prerequisite knowledge to understand it. A good example is in pharmacology, where preliminary in-vitro experiments (experiments that are done outside of a living organism) of a drug as a possible treatment of a disease are touted as a 'new cure' by popular science journalism outlets. They fail to communicate the vast distance between these in-vitro experiments and actual approval for commercial use of that drug in humans. Providing an incomplete picture can be harmful.

You are responsible for misinterpretations of your work

One of the characteristics of good science journalism is unambiguity. As writers, it is our responsibility to ensure that our work is straightforward and concise. Misinterpretations, particularly those that target minorities or reinforce harmful stereotypes, are dangerous. Clark et al. conducted an analysis of IQ for different countries and concluded that the 'national IQ' of some African and Asian countries was below 50 (Nepal: 43.0, Sierra Leone: 45.1, Guatemala: 47.7). The DSM-5 lists an IQ below 70 as an intellectual disability. Christian L. Ebbesen explains why this paper was flawed in many ways: the way in which 'national IQ' as a quantity was defined, the dataset that was used and the problems of using IQ itself as an indicator of intellectual ability. It is easy to see how incorrectly reporting on Clark et al. can allow a reader to draw the false conclusion that people of specific countries are inherently unintelligent and be used to justify racist tropes.

All that glitters isn't gold

I used to hold scientific papers to be the gospel truth, but not all science is done in good faith. Misconduct and falsification of data, though usually eliminated during peer-review, can still find their way into published literature. This paper in *The Lancet* that studied the usage of hydroxychloroquine to treat COVID-19 patients caused a flurry of news outlets covering it. Given the urgent need for research on COVID-19, such papers were accepted in a hurry. The Surgisphere Corporation, who were responsible for data collection and analysis for the study, did not share the complete dataset with independent third-party reviewers, and their results could not be verified. The paper was subsequently retracted, but not before it had done its damage.

Neutrality doesn't exist

A common guideline in journalism is to remain neutral to all parties that are being reported on. Not only does that base itself on the assumption that we as writers are unbiased and perfectly rational, but also presupposes that all parties are equally responsible, ethical and competent. Neutrality in times of inequality favours the oppressor, not the oppressed. Playing the devil's advocate, which may be a tool to explore both sides of an argument, can also downplay the seriousness of certain offenses.

Good readers make good writers

This is a no-brainer, but it is easy to underestimate the impact reading has on writing. I have found that critically analysing other pieces of science journalism is helping me build a list of 'things that work and things that don't', and I can see the way it has helped me develop my own style.

Appreciate your own work

In the middle of research, deadlines, citations and editing, I sometimes forget to look back and appreciate the work I have put out and see how far I've come. While the compliments on my writing skills feel nice, hearing about instances of when my work has touched someone or made a difference to them (as was the case with our Pride edition in June) is a special feeling altogether and drives me to create more meaningful content. Improvement and growth are slow processes that are hard to detect, but give yourself a pat on the back when you've made something you're proud of.

—Ira Zibbu, B '19

The Face of the Cosmos

Carl Sagan was an American scientist and science communicator, best known for *Cosmos*, a television series that first aired in 1980. Born in Brooklyn, New York, his passion for science began at an early age. Even though his parents 'knew almost nothing about science', Sagan said that his sense of wonder came from his father, an immigrant from present-day Ukraine, that his mother lent him her scepticism, and that those two modes of thought, though they did not mix well together, were vital to the scientific method and were important in his make-up as a scientist.

He received his first degree, a BA, from the University of Chicago, since it was one of the few institutions willing to admit a 16-year-old. He continued there with his BS and MS degrees in Physics and also his PhD with a thesis entitled 'Physical Studies of Planets'. He was denied tenure at Harvard after working there as an assistant professor for seven years. This was said to be mainly because his focus was spread out over too many fields. Gerard Kuiper, who was his dissertation advisor, said, 'Some [people] work best in specializing in a major program in the laboratory; others are best in liaison between sciences. Dr Sagan belongs in the latter group.' However, these widespread interests are perhaps what made him successful as a communicator.

The Pioneer Plaques—small metal plaques containing information about Earth and humans placed aboard Pioneer 10 and 11—and the Voyager Golden Records—phonograph records on Voyager 11 and 12 with music and images—were, according to *Carl Sagan: A Life*, inspired by a time capsule he saw buried at the New York World's Fair. It was at the same fair that he witnessed television for the first time and was excited and amazed by its potential.

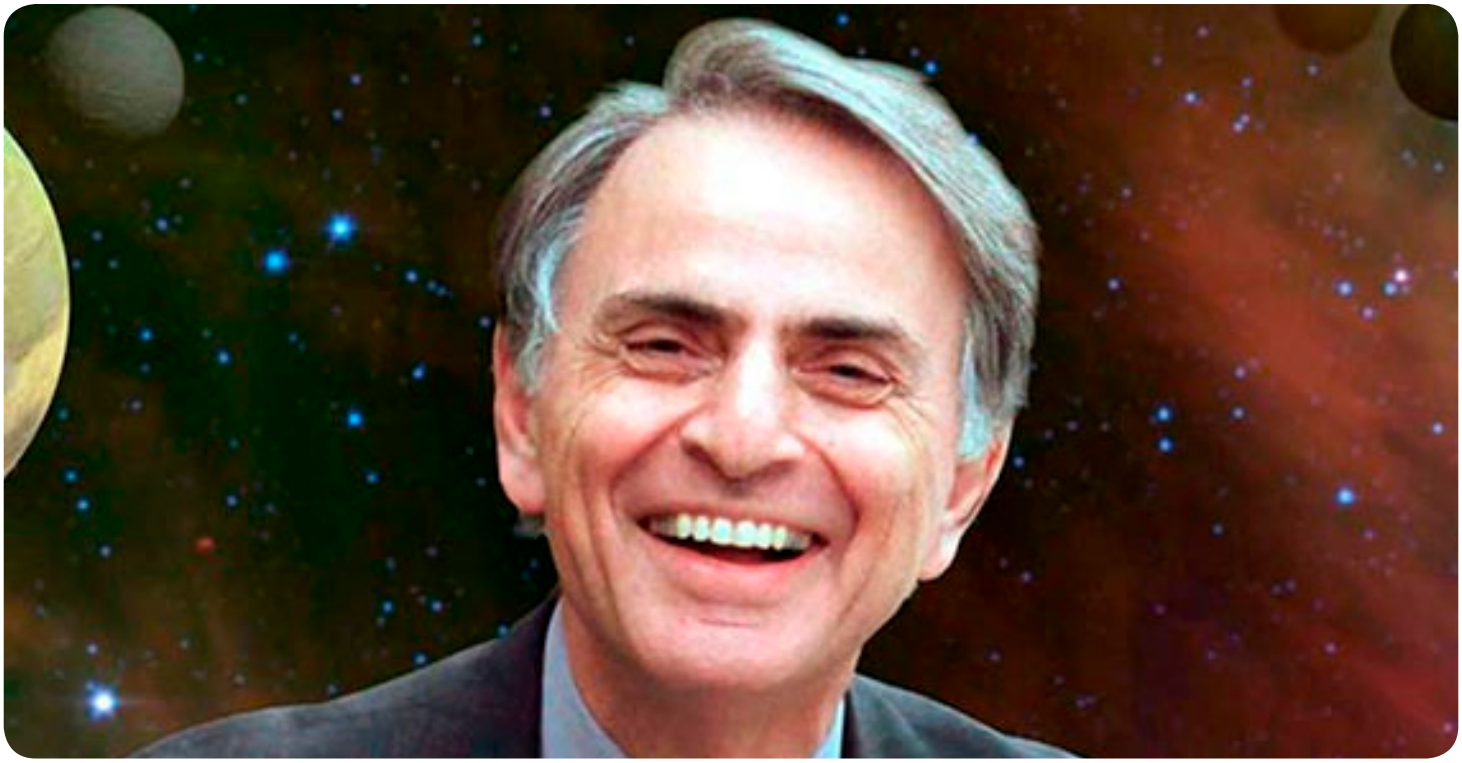
He appeared several times on *The Tonight Show with Johnny Carson* as the 'house astronomer', wanting to speak to everyday people about science as he felt scientific curiosity and critical thinking ability in the general public decreased immensely as a result of the lacklustre educational system and the decline in big science post-Cold War. He wrote and co-authored several books that made scientific discoveries and developments accessible to the public. He was a prolific writer and had over 20 books and 600 scientific papers to his name. Following his Pulitzer win in 1977 for *The Dragons of Eden*, he was asked to write and narrate Cosmos. While his time on *The Tonight Show* had helped cement the idea of a celebrity scientist, Cosmos propelled him to global fame.

Sagan gave out two reasons for scientists to share science. The first was self-interest—to secure funding for research—and the second was communicating one's own excitement about science to others.

He wasn't as well-liked within the scientific community—his work was regarded as non-rigorous and superficial. However, even his harshest critics, including Harold Urey who thought Sagan received too much publicity for a scientist, eventually came to realize that scientific advocacy had its benefits. Whether or not the academic work Sagan did was monumental, the impact he had on science communication and the public perception of science definitely was. His legacy will go on to inspire countless others.

—Rithika Ganesan, B'19

References: [1], [2], [3]



Fantastic Science and Where to Find Them

Science is the tool we use to understand the world around us. Hence, we must be aware of its potential and shortcomings to best experience life. We may choose not to do science, but we cannot ignore it as the products of science permeate our lives and our daily decisions. Consequently, effective science communication is essential.

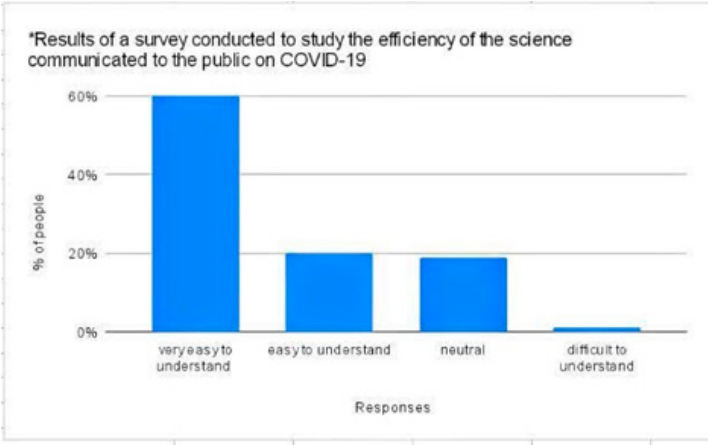
The success of scientists' communication depends on their awareness of the role that their work plays in public discourse, addressing the perspectives of various stakeholders. Communicating your research is as important as the research itself, which is why it deserves equal work, and should not end up as an afterthought. At both the individual and social levels, the stakes are too high to rely on intuitive theories and anecdotal observations about communication. Thus, we need to learn, research and analyse the best way to communicate.

Just as there is science to be communicated, there is a science of communication.

1. Perceive science communication as a two-way conversation with the public and the experts, highlighting the segment of science that is most relevant to them.
2. Focus on making it simple and accessible. The usage of scientific jargon increases the difficulty in reading due to problems created in differences in vocabulary.
3. Experiment with new methods of science communication. Along with the classic methods of articles, conferences and press, mass reach platforms like social media, blogs and vlogs should also be adopted.
4. Listening is as integral a part of science communication as any of the other mentioned points. Listening to the trends of communication in the contemporary world and learning through various other forms improves a scientist's contribution to this.
5. Understand the beliefs that individuals bring to scientific discourse. Some scientific results are difficult to comprehend whereas others go without saying.
6. Overcome misconceptions, sometimes a product of clumsy communication. Ineffective communication can be costly to science as well as to society.

Science communicators should strive to bridge the gaps between the expert and the public and ensure that critical information is central in public discourse. It is important to acknowledge the diverse nature of the public, and how impractical it is to expect everyone to be an expert in every field. The nuisance of misinformation is no stranger to us, and it is leading to extremely undesirable outcomes. When so much information is floating around, it becomes hard for the public to determine a legitimate source. The ability to detect sample bias and illegitimate data, visualise non-linear trends, verify information through references, etc., are just a few examples of skills that scientists are trained in. Unfortunately, due to misplaced priorities in the public education system, the general public might not be exposed to these. Therefore, we must always account for these when communicating science.

Here's a rough description of a survey (see figure) which followed the aforementioned multidisciplinary necessities in science communication, done to study



the effectiveness of the same in the light COVID 19, the peak of science journalism. Find the entire survey here.

Baruch Fischhoff said, 'Science provides a sense of wonder, not just by revealing the world to us but also showing us that the world can be revealed.' Thus, if we succeed in fair communication, the public will get the greatest value from our science, and science will retain its rightful wonder.

—Aiswarya P. S. (B '18) and Megha G (B '19)

References: [1], [2]

Society and Science Communication

—Aiswarya P. S., B '18

The blue represents the scientific world and orange the common world of people. When a scientist is done expressing his work, he extracts the parts of his work which are relavant to the people of society, which is the most essential step in science communication. This leads to the common people understanding it better and propogating it amongst themselves. Thus creating a world where scientific ideas live in balance with the society.

ESI Species of the Month: Malabar Gliding Frog

As the monsoon wanes, it would be a shame to not talk about frogs!

One of the most exciting species found only in the Western Ghats, the Malabar gliding frog (*Rhacophorus malabaricus*) of the *Rhacophoridae* family of tree frogs resides in evergreen forests. What's so exciting about them? Read on to find out.

Description:
About 4 inches long, the species shows sexual dimorphism, with the females much larger than the males. Skin on the back is finely granulated and vivid green while the pale-yellow belly is more granulated. The wide webbing between their digits (fingers and toes) is orange-red. They have disks at the end of their digits that are as large as the tympanum (membranes on the side of their heads that serve as ears), a distinctly pointed snout and large eyes with horizontal pupils.

Habitat:
These can be found in bushes and shrubs around any shallow pond or in water fountains in houses. Primarily nocturnal, they are active from evening to late night.

Behaviour:
These species developed on the treetops but still needed water, so they had to climb down every time. In response to this challenge, the frogs evolved to glide! Tree frogs developed extensive webbing between their digits, which helps them 'glide' from treetops. These tiny creatures can glide through astonishing distances of 10–12 feet in a single jump! This gliding behaviour is exceptionally helpful to escape from predators like snakes. Their long legs also make them excellent climbers.

Breeding:
The frogs breed during the monsoon season. The mating call is a soft 'tuck-tuck-tuck'. Like any other frog species, many males will try to mate with a single female. The couple build a foam nest above small pools of water and the female lays her eggs inside it, from which the tadpoles drop into the water after hatching.

Though the IUCN describes the species as Least Concern, their numbers are decreasing due to extensive deforestation and habitat destruction in the Western Ghats.

We can only hope that the frogs can glide away from this problem.

—Vidyarashmi Hanehalli, B'19
Sources: [1], [2]
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We hope you enjoyed this month's edition of Exhibit: A!

The views represented in this newsletter do not necessarily represent the views of Anvesha as a club. Exhibit A is a collaborative initiative, and we strive to make it an expressive platform that enables a free exchange of ideas.

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Have any science-related questions you'd like answered? Send them to us and we'll get our best minds on it!

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