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sentience.iiserpune@gmail.com

Editors

Ashwini Ramesh
Darshini Ravishankar
Harini Suri
Khilav Majmudar
Lokahith Agasthya
Mangesh Sonawane
Radhika Ravikumar
Sahana Srivathsa
Shruti Paranjape
V R Shree Sruti

A Science Feast

Siddhartha Sohoni



Photo : Manish Kumar Tekam

“Mimamsa” in Sanskrit, means... well, we have all Wikipedia-ed what Mimamsa to the general public. However for us, (definitely not the general crowd, are we?) it means only one thing- fun! After months of organizing, emergency meetings, senior-junior-bashing, rejected questions and publicity stunts, here it was! India's most challenging and concept-driven science quiz got off to a beautiful start. The participants and spectators were greeted on the morning of 15th February with an elegantly decorated HR4. The walls were adorned with charts that had fun science facts on them and on the reception floor displayed one of the most scientific flower rangolis that IISER had ever seen. Mimamsa's venue, C-201 dazzled as well. The Art Club had pulled off the decorations for yet another event.

The four finalists this year, IISc Bengaluru, IIT Bombay, UM-DAE CBS, Mumbai and St. Xavier's (autonomous) college, Kolkata, had been selected via a rigorous preliminary written round. The ever efficient organizing and hospitality teams saw to it that all the needs of the participants were fulfilled, which was reflected in the participants' feedback on Mimamsa. All the participants ate, along with the judges and other VISs (Very Important Students) associated with Mimamsa ate in the participant room (read faculty

lounge). The best surprise of Mimamsa was the food! The only word on everyone's lips about the food was 'awesome'.

And now, to the real event! The quiz consisted of four rounds- Physics, Chemistry, Mathematics and Biology. Each round was further divided into three sections- Brief Thought, Analyser and Deep Thought. Other rounds included the Occulomotor (audio-visual) and Stepping Stones (Rapid Fire) rounds.

There were expositions, wherein all the teams presented a topic of their choice for half an hour. Every exposition and subject round had a judging panel that cross-questioned the teams and presented answers to unanswered questions.

Kudos to the hardworking, caffeine-fueled question-making teams for making intellectually stimulating questions that made all the teams sweat it out.

At the end of two days of intense quizzing, the team from IISc, Bengaluru won the event (for the third consecutive time) with the team from St. Xavier's, Kolkata coming second.

The organisation of the event went off smoothly with the aid of dedicated blogging and scoring teams and the impeccable timing of the projection and audio teams. All in all, the two days of Mimamsa were fun. Here, if not anywhere else, did all of us realize the joy of hard work!

Pro-Protein Meet

IISER-P hosted an India-UK Scientific Seminar on “Complementary Approaches in Structural Molecular Biology” from 27th to 29th January 2014. The aim of the meeting was to discuss the latest developments in the field of structural biology, and to promote interaction, collaboration and networking amongst researchers from India and the UK. The 20 participating researchers shared their expertise in diverse yet complementary fields of research applied for understanding the structure and function of biomolecules. The fields included X-ray crystallography, electron cryomicroscopy, spectroscopic techniques such as NMR and resonance Raman, super-resolution microscopy, and computational and systems biology. The meeting was co-organised by Prof. Ravi Acharya, University of Bath, UK, and Dr. Saikrishnan Kayarat, IISER Pune, and spon-

sored by DST India and Royal Society.

The three-day meeting was followed by a one-day symposium on “Proteins: Structure, Function and Dynamics” on 30th. 12 eminent structural biologists and protein chemists from India and the UK presented their research to an audience of researchers and students from Pune and Mumbai. The enthusiastic participation of students from IISER, NCL, NCCS, University of Pune, IIT Mumbai and colleges from Pune, made the symposium a success. This symposium was co-organised by IISER-P, NCL and NCCS, and sponsored by the UK Science and Innovation Network, Avantor Performance Materials and GE Healthcare Life Sciences.

See : <http://royalsociety.org/grants/schemes/india-uk-seminars/>

Dr Gayathri

Slytherin' Scenes

I was rather scandalised when I heard someone say ‘I saw them mating!’, looking at other side of the pavement, on the path to the labs from the hostel. To figure out the truth behind this statement, I looked down, to see snakes (to my relief!). So there lay the proof of the claims by the series of mails about snakes roaming around our campus!

Initially it was only a snake-skin that was found lying around on the road, glistening in the sun, attracting a few “eww”s from some and “wow”s from others. Later it was as though one was running a race along-side these creepy-crawlies while rushing to one’s lectures. There was also an incident in which a snake was found with its head chopped off and discarded.

The snakes seem to come out from their holes (which I couldn’t find when I went searching for them) a lot now; to sun bathe perhaps? While on a quest to discover more, I found snakes (maybe three or four) of various lengths and colours, loitering around the same area, day and night. The real question is whether they are venomous or not. So, the next time you are rushing to LHC or the labs, do take a look, if you don’t fear snakes, and let the others know so that we can assess this serious situation of snakes. Till then, we will have to share our niche with them and coexist peacefully.

Disclaimer: Don't try being adventurous unless you are sure about it!

Salazar Slytherin



Photo: carbuzzart.com/

Clean Up!

Nilima Walunjkar

As a part of its green initiative, Prutha has been organising clean-up drives in and around IISER. After a successful drive at Panchavati hill and one in IISER last semester, we decided to have a ‘Clean Up IISER’ drive this semester, only a month after the advent of the spring semester, as we began seeing paper cups, tetra pak cartons and cans lying around campus, everywhere from the laboratories and the hostels to the volleyball court and cricket ground.

At 5:30 pm a bunch of students set off from the LHC, on a mission to get IISER spotlessly clean. We walked all the way to HR-4 (we did not take the shortcut) and then to the New Hostel picking up the various kinds of trash lying around, from soda cans to empty chips packets, straws, candy-wrappers, and shredded paper plates.

As classes ended, people trickled out and to our delight some non-Prutha members joined us. The total number of people who joined the drive was twenty, which was significantly higher than the last drive. Some of us brought nitrile gloves with us from the laboratories to wear while picking up litter.

The Director, who was walking towards Mendeleev, stopped in surprise at the sight of volunteers wading through bushes along the road and then expressed his happiness that we had taken this initiative. He later sent out an email expressing the same.

As we continued strolling down the paths of IISER picking up trash from nooks and corners, we wondered how the trash ever got there in the first place. Considering the fact that IISER is filled with intellectuals who understand the importance of keeping the environment clean, it saddens us that we still managed to collect three large bags of trash.

A Sentient note : These greenies were so dedicated that they came late for the Sentience dinner (which coincidentally, was on the same day) even though they were being treated!

Rise of the Bathroom-Singers

Sumeet Kulkarni

Students walking in to enjoy yet another delectable dinner in the mess on Friday night, the 31st of January, were greeted by melodic noises reverberating across HR-4. The source? Aaroha, the music club of IISER Pune, was hosting its first-ever Karaoke night, open to all. People thronged the little bamboo enclosure in the mess (the former faculty lounge), where a large make-shift projector screen had been set up to display the lyrics of popular tracks, in both English and Hindi. Students from all batches sang in a loud, unified voice. Bathroom singers replaced their shampoo bottles with real mics to realise their dream of becoming playback stars, if only for one night!

Starting off by straining their vocal chords to produce all sorts of sounds in Ylvis' viral song 'What Does the Fox Say?', their voices held up to sing the rest of the songs with the same level of enthusiasm. Endless requests were made from a large playlist that had been assembled - Bon Jovi, Rock On!, Queen, AR Rahman, and Oasis amongst others. Bringing order to the chaos was Vrushali Rao's amazing rendition of Adele's 'Rolling in the Deep'. It was followed by more tireless singing, until 10 pm when to everyone's dismay, the dining hall had to be closed. We at Aaroha were delighted at the response, and promise to hold more such exciting events in the future.

License to Vote

Lavanya Lokhande

A Voter Registration Drive was organised in IISER-P, from 24th January. The first couple of days was to spread awareness- banners were put up in HR-4 and the Lecture Hall Complex and posters on all notice boards. It was decided that a booth would be set up from Monday, the 27th till Friday, the 31st at the HR-4 reception area. Hard copies of the form were available at the booth. Students volunteered for this project and helped in the setting-up and

managing of the booth. The booth was kept open mostly during lunchtime. On the last day i.e., Friday, it was open from 11am to 4pm. A drop-box was made available at the HR-4 reception. In the end, we got a total of 172 forms from the students, faculty and staff. This drive would not have been possible if it hadn't been for the constant support of Dr. Suhita Nadkarni, and the Institute and all the volunteers who helped make it a success.

Academic Buzz

Radhika R

The UGC-CSIR National Eligibility Test (NET) conducted by Council of Scientific and Industrial Research (CSIR) and the University Grants Commission (UGC) to select candidates for college level lectureship and for the award of Junior Research Fellowship (JRF). The exam is categorised into Life Sciences, Physical Sciences, Chemical Sciences, Mathematical Sciences, Engineering Sciences and Earth, Atmospheric, Ocean and Planetary Sciences.

Junior Research Fellowship (JRF):. Resident, bonafide Indian citizens meeting the required educational qualifications can, if selected, avail this fellowship for a period of 5 years to pursue a PhD in any of the above listed areas at an Indian institute or R&D establishments of a government-recognized public or private sector industrial firm recognised by the government.

Lectureship: For eligibility of recruitment as a lecturer, in addition to NET, State Eligibility Test (SET) is conducted in English and select vernacular languages in some states.

The exam consists of an MCQ paper with three rounds. Part A is a General Science and Research Aptitude paper. Part B is subject-oriented while Part C is a test of scientific concepts and their application.

Schedule of exams: NET is conducted twice a year in June and December, and the details are put two months prior to the exam. The results are usually announced in October and April respectively.

For further information please visit:

<http://www.csirhrdg.res.in/>

<http://115.112.95.106/jrf/online/index.jsp>



IPL Bowls Over!

Photo : Manish Kumar Tekam

Say “Cheese” Spread

Bharath Krishnan

One very frequently witnesses or takes part in the legendary debate concerning the future of our country. Most citizens tend to have a sudden sense of patriotic fervour and express their opinions about the important issues that grip India viz. poverty, illiteracy, etc. What is highly unfortunate about these debates is the fact that this sudden burst of newfound ambition and devotion eventually dies down as we get busy with our routine, mundane chores. This is primarily because we do not get the right opportunity to make our services available.

‘Spread the Smile’ is a novel initiative conceived by Disaha. This program gives go-getting volunteers the opportunity to spend a weekend in a village near Pune and interact with the children there. The program is spread over four weekends in

the months of January and February. The primary motive of this program is to inculcate some sort of scientific temper in the children and spread the joy of education through fun-filled experiments and activities, contrary to the method of our education system. This year, the program focussed on seven villages around Pune namely Kadadhe, Kanhewadi, Kondhanpur, Kusgaon, Male, Kurunji, and Mangdari. A total of 113 volunteers registered for the program. The program commenced on a Saturday with scientific demonstrations that elucidated various scientific principles of air-pressure, centrifugal force, refraction, etc. A broad assortment of activities that included origami sessions, outdoor activities such as cricket and other games rarely played in cities (like Ram-Ravan), drama sessions

and movie-screenings were conducted. In some villages, a star-gazing session was conducted with the help of a telescope. The second day consisted of various activities that were new to the children, including bird-watching, map-making and nature walks. ‘Spread the Smile’ not only gives you the chance to experience village life but also changes your perspective of our nation. I am positive that we learnt much more from them than they learnt from us. The image that we have of urban India is alien, the real India is out there in the villages. This immensely gratifying experience had many facets to it. I for one, am sure that the vivid images of those wide smiles on the faces of the children are probably going to resonate in my head for many, many years to come.



Midnight Melodies

Divya Gadkari

It was that time of the year again, when IISER students prepared themselves for the upcoming Republic Day. As enthusiastic discussions about the country’s past, present and future ensued, SPIC MACAY added to the fervour by hosting its second overnight concert, on the 24th. The stage was setup in the beautifully decorated Multipurpose Hall (C-201). The first concert by Pt. Raghunandan Panshikar, a renowned Hindustani classical vocalist, started around 9PM. After a splendid rendition of the Raga Bhoop followed by Raga Rageshree, he presented a beautiful Marathi Bhanjan, leaving the audience entranced.

The next concert which started at 11PM was by Sri.Sikkil Gurucharan, who is one of our times’ leading young Carnatic vocalists, and hence, is popular amongst the younger generation. The concert started with Gurucharan ji telling the audience a few things about Carnatic music and lightening the mood with a few jokes. He started with a va-

ranam in Raga Thodi, followed by a composition of St. Thyagaraja in Raga Malvi, and an enthralling exposition of Raga Lalita. The audience was then treated to a spectacular rendition of an Ashtaraga Mala, literally meaning ‘Garland of Eight Ragas’. In this piece he sang eight ragas, transitioning from one raga to another effortlessly, and singing every one of them with brilliance. The loud applause clearly indicated the sentiments of the audience. When it was past 12AM, an air of tranquillity and calm set in. At 1:30AM of the 25th January, the third concert started by Pt. Ronu Mojumdar, a world-acclaimed flautist. He started with Raga Darbari Kanada, followed by Jinjavati. The pleasant sound of the flute drifted across the hall, hypnotising the audience. After these performances, a request of the famous Kashmiri Dhun was made, to which Ronu ji responded heartily. As he played the tune on his flute, one could perceive the great mountains and the echoing

valleys of Kashmir through the music.

The fourth and last concert started at 4AM, and was by Pt. Nayan Ghosh, who is a distinguished sitar and tabla player. Before starting, he explained to the audience that, it was a challenge for him to perform at that time of night, as there are only a very few ragas which can be sung at that time and that one required a lot of concentration to experience them. He explained that these Ragas combine the stillness of the night with the hope of the coming day. Accompanying Pt.Nayan Ghosh on the Tabla was his 13 year-old son, Ishaan Ghosh. Nayan ji started his captivating performance with Raga Kausi Bhairav, followed by the Raga Bhatiyar, and concluded, as is the custom, with Raga Bhairavi. Nayan ji and his son, whose age was deceptive of his talents, gave a magnificent performance. The concert came to an end at 6AM, and the audience oblivious to the sleep lost, felt alive but tranquil at the same time.

Nobel Words from Venki

There is not much by virtue of an introduction that one can say about this Nobel Laureate. His work is seminal, but his path to success wasn't without hardship. His simplicity took us by surprise in our interview of him. Read on to find out more about Prof. Venkatraman Ramakrishnan.

ST: How did you enter the field of science?

VR: It's hard to say. My parents were scientists. But I think that at the early stages, it wasn't clear that I wanted to be a scientist. I became interested in science and mathematics due to a teacher in high school. But I was still confused. In those days you did pre-science after high school, so you had to finish high school and then go to pre-science, and after that you split off into engineering, medicine or a BSc course. Around this time, I took the National Science Talent Search [Exam], and cleared it. That scholarship was given only for basic sciences. So I sort of thought it as a sign that I should do basic sciences.

ST: So your journey in science began with physics, but you're more well-known for your contributions to structural biology. How did you switch between these two fields and how difficult was this switch?

VR: The schools I went to for undergraduate and graduation in physics were not front-line schools and so I don't think I necessarily got the best training. It was very clear to me that I would not make it as a first-grade physicist. That's one reason. The other reason was that I would read about all these huge advances in biology, especially in molecular biology and cell biology. It struck me that this was a much more exciting sort of way of spending one's life, rather than doing some sort of second-rate work in a mature discipline. I did that and I actually knew many physicists who made the same transition

ST: Was it difficult switching between the two fields?

VR: I made it easier by going to graduate school again, and sometimes you have to step backwards in order to go forward again. When I went back to graduate school, I didn't even know any undergraduate biology, because of the way the Indian system is, i.e. one specialises fairly early. (Well, now, hopefully at places like IISER, you can have a broader background). Anyway, I didn't know undergraduate biology, so I had to take undergraduate biochemistry, genetics and cell biology along with my initial graduate courses as well.

ST: You were awarded the Nobel Prize in Chemistry for studies of the structure and function of the ribosome. Could you tell our readers more about the research that led to the prize?

VR: People often say it's chemistry, but you have to realise that chemistry is a very broad field, and it can encompass everything from applied physics, all the way to problems in molecular biology. I was just awarded for my work in molecular biology, which was to help solve the structure of the ribosome. It's absolutely essential to life as we know it and that's why it's important.

ST: You're also a major advocate for the judicious use of antibiotics and anti-microbial drugs. How did you get involved in this effort?

VR: Very indirectly, because many of the clinically important antibiotics target the ribosome, and so once we had solved the structure of the ribosome, we could also understand how these antibiotics bound to it. That led to companies being interested in using these structures for developing new antibiotics, and that led to me becoming involved, first with a small start-up company in Cambridge and then, with a company called Ribex. Working with these companies made me realise how difficult it was to develop any useful new compound. It's why there are so few new antibiotics and that made me realise that the abuse of antibiotics is actually terrible, because we have all these useful

antibiotics, and if we render them useless, then we're hurting ourselves.

ST: What are your hopes for the future of science in general, and science in India in particular?

VR: Well, I think it's difficult everywhere. It's harder and harder to get grants. I think in India, science funding has improved a lot over the last 20 years. Luckily there are quite a few Indian institutes which I think are doing good work, and the hope is that in time they'll do great work. So I would be optimistic. But there is one problem, and that is science is expensive.. Governments really shouldn't bother cutting science, because if you cut it, you disrupt a long process, because it takes a long time to train people. If these people leave science, you have to find new people and train them all over again. It's a waste



Photo: <http://1.bp.blogspot.com>

of time and money to cut science.

ST: Could you tell us about your interests outside of science?

VR: I have various interests. I like music, literature, hiking, bicycling and movies. I have a wide range of interests.

ST: Do you have any words of advice for the students?

VR: I think students and young scientists should look beyond doing the next experiment, start asking what the really interesting question in their field is, and try to think how they could go about attacking it. I think students should be encouraged to think, to be interested in their work and to ask why they're doing something. "I'm spending part of my life working on this, why should I be doing this?"

Demystifying Diffusion

Naven Narayanan

The term 'diffusion rate' is widely and very commonly used by all scientists, be it physicists, chemists or biologists. The term is considered by many to be the rate of diffusion and hence is completely dependent on time; but is it really? Before we dissect this term, let us look at what diffusion actually is. A random protein molecule has, in general, velocities ranging from 10-15 m/s, which shows that it would probably give Usain Bolt a run for his money (pun intended)! One can imagine it to traverse our hostel rooms in about half a second, provided there are no obstructions. This molecule will somewhat slow down in an aqueous medium (which is what we will assume throughout this article). Obviously this protein molecule will bump into some water molecules and randomly move around in all directions in the fluid. This is, quite simply the definition of diffusion.

For simplicity's sake, I will consider this molecule to be purely constrained to move along the x-axis and to be at rest at the start of our observation. Now our particle can move to the left or right by a distance d in a certain time period t and hence it will have a velocity v . Again, to help ourselves, we assume t and d to be constant though practically, they vary significantly. Now, the probability of the molecule moving to the right or left is 0.5 each. These particles (as I will refer to them from now on) will interact with the surrounding water molecules and 'forget' what happened and therefore every step is unbiased. Successive steps are statistically independent. We can also assume that these particles don't interact much with each other, especially in dilute solutions.

Let us now get to the heart of the matter. Consider an ensemble of N particles. Let $x(n)$ be the particle position after the n^{th} step. By our initial 'rules', the position of the particle would be $x(n) = x(n-1) \pm d$.

This is because the particle can move

in either the left or right directions. The mean displacement can be found out by summing over the entire range of particles and then dividing by N . The second term i.e. $\pm d$ can be eliminated as, in any large set of particles, the movement of the particles to the right and left will generally work out to be the same. Hence we will get $\langle x(n) \rangle = \sum x(n-1)/N = \langle x(n-1) \rangle$ where $\langle x(n) \rangle$ and $\langle x(n-1) \rangle$ are the mean positions of the particles at their n^{th} and $(n-1)^{\text{th}}$ steps respectively.

This tells us that the mean positions of the particles do not change from step to step, and again assuming that the initial position of the molecules is zero, we can infer that the mean position continues to be zero. To calculate the magnitude of spreading of the particles, we go back to the time-honoured concept of root-mean-square displacement. This will give us a positive finite value and will not be zero as all the negative displacements will have been made positive. This means $x^2(n) = x^2(n-1) \pm 2dx(n-1) + d^2$.

Then for computing the mean, we use $\langle x^2(n) \rangle = \langle x^2(n-1) \rangle + d^2$. Again, the $2dx$ term is zero as the number of particles moving in the left and right direction are the same.

Since $x(0) = 0$ for all particles, $\langle x^2(1) \rangle = d^2$, $\langle x^2(2) \rangle = 2d^2$, ... , $\langle x^2(n) \rangle = nd^2$. We conclude that the mean-square displacement increases with the root-mean-square displacement, and hence that the root-mean-square displacement increases with \sqrt{n} .

Let us consider a finite time T when this process occurs n times i.e. n steps are taken, therefore $T = nt$. It follows that the mean-square displacement is proportional to t , and the root-mean-square displacement to the square root of t . Hence the spreading increases with the square root of t .

Hence $\langle x^2(t) \rangle = (t/T)d^2 = (d^2/t)T$. We can conveniently define a diffusion coefficient $D = d^2/2t$ which gives us $\langle x^2 \rangle = 2Dt$ and $\frac{1}{2}\langle x^2 \rangle = \frac{1}{2}(2Dt)$.

The diffusion coefficient characteris-

es the migration of particles of a given kind, in a given medium, at a given temperature. For a small molecule of water at room temperature, D is approximately 10-15 cm^2/s . For various values of x , we can see that time varies exponentially. For a particle to travel twice any distance, the time taken will be four times the original time. This is a way of visualizing what is actually happening. Therefore there is no such thing as diffusion velocity as displacement is not proportional to time but rather to the square root of time. To further this argument, let us divide the root-mean-square displacement by time and assume it to be a diffusion velocity v . The result is an explicit function of time equal to $(2D/t)^{1/2}$.

When we observe this equation, we can see that the shorter the period of observation, T , the larger the apparent velocity. For values of T smaller than t , the apparent velocity is larger than $d/t = v$ which is the instantaneous velocity of the particle. This is terribly absurd and stupefies people in general.

All said and done, we can identify two key-points : one being that the particles go nowhere on average, even though individually they can travel infinite distances, while the second and more shocking point is that their root-mean-square displacement is proportional, not to the time but to the square root of it.

And there you have it, the next time you hear or see the term 'diffusion rate' you can just feel that bit smarter, because you know they're ignorant of the secret you know.

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2. <http://hyperphysics.phy-astr.gsu.edu/hbase/kinetic/diffus.html>

Apparence vs. Non-Existence

Khilav Majmudar

Who, having once heard of black holes, is not fascinated by these objects? They take in everything (even light) and do not allow anything to escape. Information entering a black hole is lost forever. This is what the classical theory of black holes, according to the General Theory of Relativity, tells us. Both of these

parent horizons, which hold matter and energy only temporarily. This information is then released, albeit in an almost unrecognisable form.

Hawking proposed this theory to solve the black hole firewall paradox. To explain it, a thought experiment was advanced by Joseph Polchinski in 2012. It goes as follows: consider a



Photo : <http://businessinsider.org>

statements will be shown to be wrong during the course of this article.

There is good reason to believe that black holes do exist. Accretion discs observed have been thought to belong to black holes. The X-ray emissions, observed from some binary star systems, are generally ascribed to the accretion of matter from one star by another. This gives rise to the idea that one of the stars might be a neutron star, which if it is very heavy, could form a black hole.

The defining feature of a black hole is its event horizon. It is the boundary of a black hole, beyond which even light cannot escape. Light moves along the event horizon, thus taking infinite time to escape the black hole's gravity. Hence, it is the surface of no return.

But then, Stephen Hawking (a theoretical physicist famous for writing a book which everyone buys but no one reads) comes along and says that energy and information can escape from a black hole. This basically means that event horizons do not exist, which in turn means that black holes do not exist. Instead, Hawking proposed the existence of ap-

parent horizons, which hold matter and energy only temporarily. This information is then released, albeit in an almost unrecognisable form. He would pass through the event horizon without noticing a thing, and then gradually would be pulled inwards. He would be stretched along like spaghetti, before finally getting crushed at the singularity, the hypothetical infinitely dense core.

However, quantum theory changes the situation completely. It turns the event horizon into a region of very high energy, a 'firewall'. Upon hitting this firewall, the falling man would be incinerated. Now, according to GR, someone in free fall should perceive the laws of physics as being identical everywhere in the universe. Therefore, nothing special should happen at the event horizon. Thus, we need to abandon one of these great pillars of science.

However, we may keep both these theories intact by simply doing away with the event horizon. Thus, there would be nothing to catch fire. Hawking's claim is that quantum effects around a black hole cause space-time to fluctuate too wildly for a sharp boundary to exist. He thus invokes

an apparent horizon. For the General Theory of Relativity, both the horizons are the same. If, however, the black hole swallows more mass, then the event horizon would become larger than the apparent horizon. Conversely, the event horizon may also be smaller than the apparent horizon, as a black hole emits Hawking radiation.

Unlike the event horizon, the apparent horizon can eventually dissolve. Hawking does not specify in his paper how this would happen. But when it does happen, all the information that was once trapped inside the black hole would be released, although in a garbled form.

If Hawking is correct, there could even be no singularity at the core of the black hole. Matter would only be temporarily held behind the apparent horizon, and would gradually move inward owing to the gravitational pull of the black hole, but would never quite crunch down to the centre.

Hawking is one of the creators of the theory of black holes. If his latest propositions turn out to be true, it would be a significant step in our understanding of our universe, as it would bring the theories of GR and QM closer to unification, which is an area that is being actively pursued by the physicists of today.

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1. nature.com – Stephen Hawking: There are no Black Holes (Zeeya Merali)
2. nature.com – Astrophysics: Fire in the Hole (Zeeya Merali)

Disclaimer: At the time of writing this article, the paper which is its subject had yet to pass peer review. So, it may very well turn out that the contents of this article concerning the said paper are entirely fictitious.

Heirarchy or Heritage?

Sahana Srivathsa

The rich and diverse Indian heritage is one which stretches back many centuries and is part of one of the oldest civilisations on Earth. However, one aspect has remained constant through time, from the time of the Pandavas and Kauravas engaged in perpetual strife to the idyllic rule of Ashoka and Harsha, from the invasion of the Mughals to the British era and to our present day government: monarchy. Wait a minute, backtrack—did I just say the present day government and monarchy? No, that is neither a typing error nor an effect of sleep deprivation. As a self-respecting Indian, I am aware that we gained independence on August 15th, 1947 and formulated a constitution, declaring ourselves a democratic nation in 1950. However, just because our constitution officially declares that the government is of the people, by the people, and for the people does not necessarily make it true. The Nehru-Gandhi dynasty is, as the name itself suggests, nothing short of a monarchy.

Since we are in a science institute, let us first rationalise our train of thought and define monarchy—“A form of government where the entire power lies in the hands of one person and successors are chosen through the family lineage.” India gained independence 66 years ago and has been ruled by a member of the Nehru-Gandhi family for more than 40 of those, passing from father to daughter to son to daughter-in-law and now son again?

Let us start off with a little history lesson, a timeline of sorts. As most of you would remember or have some vague recollection of (unless you somehow managed to sleep through all your history classes) the revolt of 1857 was officially known as the “First Revolution of India”, the aftermath of which resulted in the British murdering all those of Mughal descent. To protect himself and his family, Ghiyasuddin Ghazi changed his surname to Nehru which proved to be very use-

ful in the future when Motilal Nehru, his son, entered the political fray and went on to become a two-time president of the Indian National Congress. His son Jawaharlal Nehru, who went on to become India’s first Prime Minister and remained in power for a period of 17 years, faced several daunting tasks such as combating the incessant attacks by Pakistan on Kashmir, having to set India on a stable economic standing, and establishing strong educational, medical and other social systems. The four pillars of his domestic policies were said to be democracy, socialism, unity, and secularism. While deeply admired during his reign, his policies, especially on market capitalisation, social harmony and foreign relations, particularly the Indo-China war, have been hugely criticised and revamped over the last 20 or so years. He was happy in his comfort zone and a known conformist, not exactly ideal qualities desired in a leader of a country that had just gained independence.

His daughter Indira Gandhi, who was involved in politics and the fight for freedom from a young age, was the first and only woman Prime Minister of India for 14 long years and her gender proved to not affect her in any way at all. The name Gandhi here is a misnomer, not to be confused with M.K. Gandhi’s kin in any way—her husband changed his name after their marriage, pretty conveniently. Known for being a strong, dominant leader who never shied away from taking a stand, she led India into a new era and handled massive crises without batting an eyelid and is well-known for her famous five-year plans. Some of her policies were admittedly a little extreme and have been widely criticised, most popularly the Emergency declared in 1974. Her son Rajiv Gandhi was forced into politics with the death of his younger brother and took up the Prime Ministerial post after the assassination of his mother. He is widely remembered for creating

a strife within the Tamil community of Sri Lanka (who took their revenge), and for inspiring the naming of a large number of educational institutions throughout the country. His wife who is not of Indian origin (a fact which in most other countries would have never allowed her to enter the political arena. but then again India seems to have gotten comfortable with foreign interference and invasion) has, in the recent years, taken over the running of the government indirectly. This has resulted in the present day nest of corruption akin to the Augean Stables and it is certainly a Herculean task to rectify it. Grooming to take over is the now widely-publicised Rahul Gandhi who seems well aware of the expansion of RTI’s and the concept of women’s empowerment, if nothing else. Even over in the BJP camp, the primary opposition party, we have Varun Gandhi, Indira Gandhi’s other grandson, rising to take control.

What is the point of filling our civics textbooks with examples of democracy and praising its virtues to the skies when our nation is anything but one? Apparently, we are people who are content to let others make the decisions and rule our lives while we do naught but complain and crib and allow the same lineage to take control, akin to powerless subjects under a tyrannical monarch where half of us do not even bother to exercise our right to vote. Wake up, take charge, and make a difference by voting.

Disclaimer: This article solely represents the author’s viewpoint and is not intended to start a riot. Before you immediately condone this to be blasphemous, take a moment and think, or allow me to think for you.

There is a blog that quite a few of us here at IISER had come across, before joining the institute, while trying to find out more about it. The words written there are rather bitter, warning readers ominously, that coming to IISER Pune is a bad idea. These posts were written by a few people from the first batch, and they talk about how morose they felt and how they did not get what they were expecting at all. This was partly due to the fact that they did not receive their degree upon graduating as IISER had not yet been declared a deemed university at that time. When we think about those pieces of prose, full of umbrage and frustration, we marvel at how much things have changed. We're not talking just about the growth and construction of the campus, our club activities and fests, or all the new facilities, but about what people expect from their courses and how they feel about being here.

When IISER was first set up, many of the people who signed up to study here were unfortunately, IIT aspirants who did not get what they wanted. IISER wasn't their first choice, and they were unsure of what they were in for. They expected jobs and money to follow after spending the stipulated period here, and were disinterested in research and learning about how it is conducted. As is apparent from the aforementioned blog, they became slightly angry towards the end of their five years, disappointed that they could not avail placements or career guidance from the institute (in the traditional sense). They felt cheated, lost even. Several compared themselves to their peers in other fields, lamented that their friends had fancy jobs at this company or that, and asked themselves why they were not in a similar position, or why they had not tasted 'success' yet.

None of that is the case with the current set of students. As IISER becomes more well-known, and batches get larger and more people make an informed decision to come here, the institute's purpose and method also become clearer. We are told, the very

day we start term, that the goal of our course is not to be whisked away by some profit-centric corporation at the end of half a decade, or to claim prestigious jobs and make mounds of cash. We are here, we are told, to learn about science and the scientific method. It is emphasised that we are free to use the skills we gain as we see fit, in whatever field we choose, at the end of it all. The students feel grateful, privileged even, that they belong to the institute, and come here with genuine interest and enthusiasm. They compare themselves less with others in the standard terms for success, and realise that what they are doing demands patience

“The goal of our course is not to be whisked away by some profit-centric corporation at the end of half a decade, or to claim prestigious jobs and make mounds of cash.”

and yet is important and rewarding in multiple ways in the long run.

Most of our fellow students say that they enjoy studying here, discussing their fields of interest with their friends, and participating in scientific conversations that often have no relation to what they're learning in their lectures. Many are willing and happy participants in outside-the-classroom projects and almost all say that they want to improve the way they look at and communicate science. There is hardly any mention of monetary issues (apart from whether the monthly stipend has been deposited so that a lavish dinner may be planned) or what one will do for a steady income later, which we think is fantastic, because that reveals the true intentions of those

who come to the institute, which is to learn. The unanswered question for most students is not about what starter salary they will get or what company they'll work for, but about whether a PhD is in the offing, and if so, where?

The courses that we have, reflect this kind of mindset. Students of medicine and engineering, for example, need to learn a lot of facts to excel in their fields, while we need to focus more on the frameworks of reasoning and a general approach to problems. We try to learn the details of the process of thinking rather than the details of a set of facts. Our classes are broad in terms of the syllabus they cover and tests are almost never reliant on rote-learning, which surprises a lot of people when they come in, fresh from school. With the inclusion of subjects like HSS and TDC (Humanities and Social Sciences and Trans-disciplinary Course, for those who don't care for acronyms), it's stressed quite enough that we are required to learn to think for ourselves and handle problems on our own, not merely pass exams. Though grades do, inevitably, weigh heavily on everybody's minds, people are fortunately more concerned about whether they've left their gel running too long in the lab or whether their spectrophotometer results make any sense.

We have talked about campus culture and how different streams of students are interacting more before; this trend is something similar, that's ostensibly wonderful not only for students and their learning environment, but for the entire aim that was in mind when IISER was created, as well. The goal was, and is, to train young people, with a fascination for the sciences, in the sciences, to ensure that India has intelligent and motivated contributors to carry on in this field and work in it in the future. If the IISER populace as a whole is a joyful bunch that enjoys what they are doing, it bodes well for almost everything.

Rich Dad, Poor Dad

Shipra Kumar

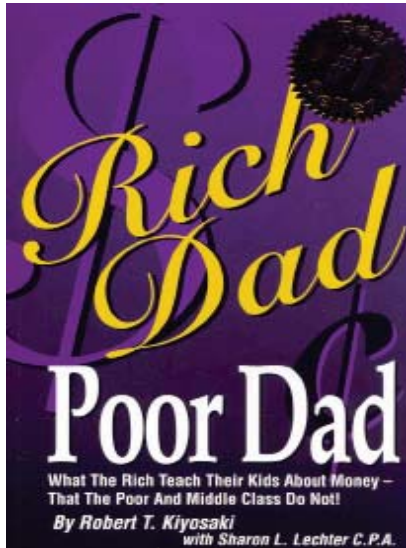


Photo: luxuryreading.com

Robert Kiyosaki's personal finance book 'Rich dad, Poor Dad' has been inspirational to many people who have laid their hands on it. 'Rich Dad, Poor Dad' is basically what I would call a perspective on personal finance, told in the form of a parable. This story, written in a first person narrative, is the story of a person (the author) who has two fathers : the first was his biological father (the poor dad), who worked a steady job for a living, and the second, a rich dad (the father of a friend), who ran a multitude of businesses. The author compares his poor dad to those people who perpetually scamper in the rat race, helplessly trapped in a vicious cycle of needing more and never being able to satisfy their dreams for wealth because of one glaring lack : financial literacy.

His rich dad, by contrast, represents the independently wealthy core of society. He deliberately takes advantage of the power of corporations, and their personal knowledge of money, which they manipulate to their advantage.

The book basically highlights the concept of how money works and also focuses on the need for financial literacy, recognising the characteristics of humans and how their preconceived notions and upbringing hamper their financial goals.

This book is a must-read for all economics-enthusiasts and also for those who want to learn some smart money-managing skills. With excerpts from his own life and many other examples, Kiyosaki has succeeded in making this book a compelling read.

Classy Arabic

Lakshman Teja



Photo : www.musicya.net

Mild strokes of the classic guitar, the Mediterranean breeze, and the wind over sand dunes come alive on hearing Arabic music. Calmness sweeps through the air around you as you plug in the music. The hand drum, the benchmark of Arabic classics, syncs with the pulse of every word of the song.

Arabic classical music fused with Indian classical music has become the Sufi style of music, considered one of the best incarnations of music of the medieval times.

Digging into the crusts of Islamic and Judaic cultures, contemporary Arabic style has been modernised by an electronic touch. Arabic pop has begun blooming, reaching the heights of other genres today. Unlike Western genres, which have morphed into completely new forms, it styles itself differently without losing its essence.

With themes of love, confession and pain coursing through its melodies, one feels as if time has frozen. Globalised Arab culture has mesmerised people with the mystique of this clas-

sical genre and has started receiving a good response to its permeation into Asia and the Western world.

Sindhi music, brewed across north-western India, is a distant cousin of the Arabic Griha style. A. Diab, Cheb Khalid, R. Ayach are notable artists whom I particularly like listening to. With these legends having retired, young disciples of Umm Kalthum and Fazira have begun rafting over a new wave of changing tides. Consisting of mono- or bi-syllabic words, it becomes rather easy to hear the words fall into crests and troughs of music, rather than the music being limited by words, or vice versa. In particular, the album "Tamally Ma'ak" (Arabic for "Always with you") marked a new millennium of versatility. With corporate companies venturing into the lucrative music industry, Arabian music has leaped over seas and biases, and trended into availability.

It may not be your cup of tea, but trying something worthy isn't a big deal. Tamally Ma'ak.

XPRESSION

Music Therapy

Vrushali Rao

*"Life is for the living.
Death is for the dead.
Let life be like music.
And death a note unsaid."
- Langston Hughes,
The Collected Poems*

Who doesn't like the sound of instruments and voices coming together to create something wonderful? Music, whether it is soothing and melodious, or loud and energetic, appeals to almost everyone in the world. In simple artistic terms, it is a way of expressing one's emotions, giving words to inexpressible feelings. 'Music' is a term that comes from the Greek word μουσική, meaning mousike, the "art of the muses".

Over generations, music has changed with the audience, evolving from tribal melodies to the royal tunes of Egypt, from traditional Indian classical music to rock and roll, pop and contemporary styles. Music enthusiasts always come up with something refreshingly new each time. New instruments have been invented in different parts of the world, each brilliant in its own unique way. One has a vast multitude of genres to choose from. Having a musical background, I can, without speculation, say that each type has something unique to offer and consists of a magic element that leaves a lasting imprint on everyone's lives.

It is a well-known fact, that aging causes memory impairment, sometimes so severe, that it plays a role in rendering a person bereft of any life experience or recollection, happy or sad. One mind-boggling case made an appearance in the form of Clive Wearing, which took neuroscientists and related experts across the world by awe. Clive, a British orchestra conductor, tenor and keyboardist, suffered from chronic anterograde and retrograde amnesia, as diagnosed in

1985. The responsible brain infection, herpes encephalitis had ceded his memory span to be reduced to just ten seconds. His condition was so severe, that he was unable to retain even simple information, such as the layout of his apartment. Despite being acknowledged by doctors as having one of the most severe cases of amnesia ever, his musical ability and much of his musical memory was intact. Now aged 75, he is still able to read music and play the piano, and has even conducted his former choir again. This illustrates the deep roots to which music can delve in our brain, and the abiding purport that it supports. Thus, we can conclude that there is more than creativity and expression that music can provide.

For many years, man has continually been looking for remedies and cures for illnesses. Medicinal drugs, Homeopathy and Ayurveda are a few we are familiar with. Music being used for healing can be traced back to Apollo, the ancient Greek god of music and of medicine. Aesculapius was said to cure diseases of the mind using song and music, and music therapy was used in Egyptian temples too. Recently, giant strides have been made in this field to recognise the potential of music when it comes to curing, and the reasons for the same. Particularly useful in combating social and psychological disorders, music has proved to have therapeutic value. This has been backed by scientific reasoning.

The brain's reward centre responds to music. A brain structure called the striatum, releases the chemical dopamine, associated with pleasure. According to Prof. Tim Griffiths, a consultant neurologist with the Wellcome Trust and Newcastle University, the brain analyses the musical melodies in one part, and responds to it in a separate part, a process, that he says, begins in the womb.

You may ask how this actually works. Well firstly, research has shown that music with a strong beat can stimulate brainwaves to resonate in sync with the beat, with faster beats bringing sharper concentration and more alert thinking, and a slower tempo promoting a calm, meditative state, which continues even after the music ceases. With alterations in brainwaves, come changes in other bodily functions, specifically those governed by the autonomic nervous system, such as breathing and heart-beat. This can mean slower breathing, lower heart rate, and an activation of the relaxation response, paving way for music therapy in chronic stress conditions. Music can also be used to bring a more positive state of mind, helping to keep depression and anxiety at bay.

Previous attempts in using music as a medicinal tool have proved successful in treating psychological ailments such as autism, personality disorders, and depression in adolescents. As a matter of fact, music has played benefactor in reducing the effects of symptoms of certain diseases like the Alzheimer's disease and is administered to patients in intensive care units or to those undergoing prolonged treatment (like for cancer) where it serves as encouragement and a rehabilitator throughout the course of treatment. The ongoing research might still be at an early stage, but academic teams are convinced that music could end up playing a much bigger role in hospitals.

Versatility, is a word that best fits the description of music. An inspiration to those who need it, and an enjoyment to those who listen to it, while to those who pursue it with mind, body and soul, music is articulation, a way of life. Give into it when you are in dire need of replenishment; for in music, there is peace.

XPRESSION

A Day in the Life of a Gamer

Anirudhan G



Indistinct noisy chatter, incessant swearing, tons of energy and obviously lots of *masti*, this is the sight of a typical multi-player gaming zone. Seated around the room are a group of guys peering into their laptops with utmost attention, as if their lives depended on it (well, in a way they do). Headphones are their armour and the mouse, their sword. They wage virtual battles and fight against their fellow brothers (although in good spirit). These guys stick together always, like a pack of wolves, covering each other's backs.

Believe me when I say that you should never get on the bad side of these groups while they are gaming. Masters of sarcasm, they have a quick and witty retort to each and everything you throw at them. If you condone it, there is always good old abusing to turn to.

If you wish to be part of their clan, then you would have to prove your mettle in the game. If you think that is easy, then you have seriously misjudged. You will need to go through hours of humiliation after which you get promoted from being a 'noob' (that is of course if you hang in there long enough).

When it comes to having a night out, you can't beat these guys. Predominantly nocturnal, they burn the midnight oil for

the love of the game. The later the hour, the more intense it gets; the more intense it gets, the greater the decibel levels become. Focus through all the commotion, and you will notice that it primarily consists of swearing, the frequency and ferocity of which will leave you stunned.

After a point you become so connected to the virtual 'you' that you lose track of the real world. You don't feel thirsty, hungry or sleepy. You forget the very fact that you are real. The only thing that matters then, is winning against your opponent. There is the occasional cry of joy, a punch on the table and a round of applause. Weekends are obviously a treat for a gamer, with them staying awake long enough to see the morning sun.

Once you become a gamer, there is no turning back. You have a name and you will have to constantly live up to your expectations. One classic feature of being a gamer is that you get to choose a name for yourself, that everyone in your clan calls you. This gives you an identity, a name used so often that people forget your real name. The plethora of names that come up in a clan are really amazing and funny.

It is always easy to spot a gamer. Sunken eyes, an 'I-don't-care' attitude, a cold demeanor, multi-faceted personality, sarcastic comments, loose fitting clothes and an extremely messy room. Oh! Wait, I have missed an important trait. You can bet on a gamer being late for everything (as was the case with the submission of this article as well). If there is one person that everyone in the clan respects, that would be the 'Pro'. These guys may not be social bugs, but they surely aren't closed to social interaction.

All in all, it is a journey of a different kind - to be a gamer. As a final note, for those people who despise gaming, well, I can only pity you for having missed a rare opportunity.

Foodie Corner

M@M

This review is for all those foodies who, waiting for the bus ride home after a sumptuous Saturday dinner, look at the countless buses headed to Nigdi and wonder what culinary delights it might have in store. After thorough research on Zomato, two of us dared to travel some 20 kilometres to sample the delicacies of 'Baba Ramdev Resataurant'. This is not a place serving sham Ayurvedic food but, among other things, delicious Rajasthani food. There is a variety of daal-baati dishes on the menu and they come with two steaming baatis, a mini-bucket of the best daal we had ever had, and a small potful of liquid ghee. The waiters there even mix it for novices to the art of eating daal-baati. Another thing we loved about the place was the thick masala buttermilk. We ended this rather filling meal with thick, creamy and divinely sweet Rabri. And dinner wasn't half as heavy on our wallets as it was on our stomachs. The ambience is just slightly more sophisticated than your regular dhaba. If you don't mind that, and around half an hour of bus travel each way to get to good food, you shouldn't miss this place.

How to get there: Most buses to Nigdi will drop you a little away from the bus depot, near a park (Bhakti-Shakti Udyaan, with a Greek-god-like statue of Shivaji with his people). Follow the perimeter of the park as it turns left and keep walking straight ahead, crossing an Indian Oil petrol pump and several tiny restaurants till you see it on your right. It is hard to miss.

Contact:

Phone: 020-27655551,
+91 9325070143