



VOLUME05 | ISSUE02 | FEB2013

# SENTIENCE

We make you news.

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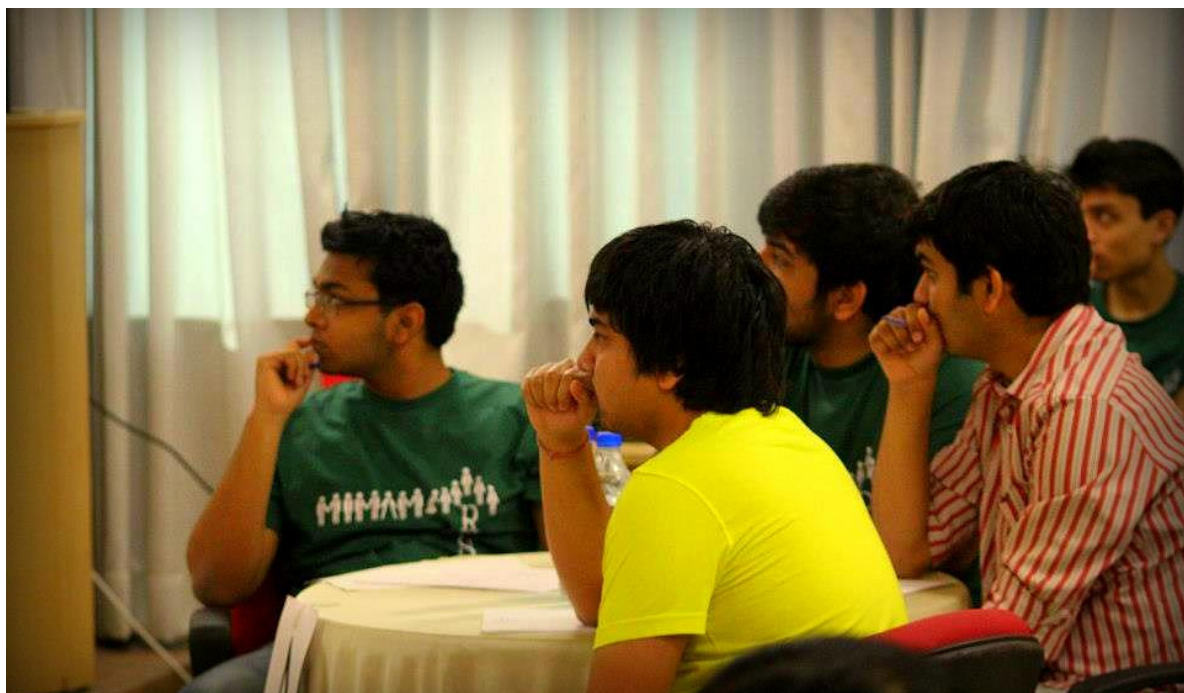


Photo by: Chaitanya Afle

## Deep Thoughts at Mimamsa 2013

After five months of steady slogging and the usual last-minute rush for questions, the finals of Mimamsa '13 kicked off on 16<sup>th</sup> February. The teams that withstood the momentous travails of the prelims were IISc Bangalore, St. Xavier's College, Kolkata, BITS-Pilani, Hyderabad and NISER, Bhubaneswar. Mimamsa is supposed to be the toughest undergraduate science challenge the country has to offer. This fact is reflected in its unique format which comprises of a series of rounds that test the teams on various levels.

In the words of one of its volunteers, the Brief Thought round tests the ability of the contestants to think, the Analyser round to think clearly, the Deep Thought round to think out-of-the-box and the Stepping Stones round to think quickly and under pressure. The teams get from 2 to 10 minutes of thinking time depending on the round and no team is denied the opportunity to express their thoughts or versions of answers. In addition, there is the Oculomotor round, the visual round with homemade buzzers and an Exposition round, where each team

has to present a talk.

Like every year, this year too, the questions were inventive with multiple layers of concepts and beautiful phrasing that involved wild characters like pirates and pink pouting piranhas! With such complex levels of testing, come equally complex algorithms for scoring-Mimamsa is perhaps the only quiz where a team can be at 130.25% in the middle of the event!

This year, however, saw an exponential decrease in external enthusiasm as volunteer seats were more populated than the audience seats through most of the contest. It was hypothesised that it may be due to the larger-than-life and more-or-less live blogging that was happening on Facebook. However, this idea was trashed as not too many people were attempting the questions on FB. We however, were graced by some royal presence in the form of "Muhammad bin Tughlaq", who ultimately turned out to be an electronics student from somewhere in India.

After two days of hard-core quizzing on four

**Continued on page 8**

## Carnival of Science

Prachi A and Sukanya J

Despite the presence of many good schools, it is a sad reality that many children in India are denied access to quality education. Disha tries to organise activities for such children. Besides our daily *Abhyasika* programme, this year, once again, we organised a '*Vigyan Mela*' for these children. The main purpose of this *mela* was to gather a large number of children from the two main economically backward areas where regular centres run, Laman Vasti and Someshwarwadi, and introduce them to the world of science and various arts.

After inaugurating the *mela* on the morning of Republic Day, Dr. Natu interacted with the children and spoke about the importance of Republic day. Then Mr. Jitender Kumar, a professional magician, entertained the children with a magic show and also explained to them how each trick worked.



Kids at the *Vigyan Mela*

Photo by: Anup Ingole

In the afternoon, Amrit Kumar, a 4<sup>th</sup> year BS-MS student, demonstrated some interesting scientific experiments to these children in the IISER campus, which triggered their curiosity. Using their creativity and imagination, they made robots, cars and houses out of assorted junk collected by the volunteers. Many other activities like drawing, and paper-cutting,

followed by another set of workshops on origami, kite-making, paper-bag making, clay-modelling on the following day and competitions like *rangoli*, puzzle-solving, etc. revealed to us the hidden talents and interests of these children.

During the *mela*, the volunteers spoke to the parents to make them aware of the importance of education for their children. At the end of the day, the children expressed their love and gratitude by gifting us clay models that they had made on their own, during the clay-modelling workshop.

The *mela* ended with a talk given by Prof. Subhedar, who emphasised on the importance of asking questions about our surroundings. We returned to our hostel with the joy and satisfaction brought by the grateful smiles on the innocent faces of the kids.

## Spread The Smile!

Over the first three weekends of February, Disha has been giving its volunteers the opportunity to 'Spread the Smile'.

After much debate, discussion, travel and convincing, the core organisers of 'Spread The Smile' decided on six villages around Pune – Ambavane, Vetale, Kurunji, Vazeghar, Hatve and Kadadhe. These villages were to be visited by four or five volunteers each, every weekend of February. During these visits, they aimed to conduct different kinds of hands-on activities and interesting demonstrations that encouraged the children there to think about the world, ask questions, and do something about the problems around them. Some of the activities conducted were map-making, paper mache, origami, quilling, etc.

In many villages, the volunteers

stayed with the children at night, and so the discussions, doubts, questions and fun continued late into the night. One of the villages was Ambavane, where child labour is disgracefully prevalent. But this depressing fact was quickly forgotten on seeing the enthusiasm of the children there. In fact, they woke a volunteer up in the middle of the night because they wanted to look through the telescope again!

The children in Vazeghar asked the General coordinator of Disha whether they could watch Dabangg after being shown a documentary called "I am Kalam". The volunteers at Hatve treated themselves to a soothing dip in the nearby lake.

The volunteers at Vetale were faced with a strange challenge - leopards. This leopard-infested region faces another funny problem - A science

teacher who was committed to convincing the children that the inflation of a balloon is due to the reaction of NaOH.

Kadadhe's volunteers found that the children there wanted to set up a library, while the children at Kurunji had grown so attached to the volunteers that they grew very sentimental at their departure.

Problems were aplenty – bad sanitation, poor nutrition, reluctant school teachers, leopards and much more. But so were smiles. Smiles on the children's faces as they roamed Vazeghar, wearing the paper hats they were taught to make. Smiles on the volunteers' faces after hearing an especially bright child's idea. And now, there's one weekend left. Don't you want to join the movement? Don't you want to spread the smile?

## Prime Achievements

IISER's research scholars, Mr. Shyamapada Nandi and Ms. Aparna Banerjee have been individually awarded the Prime Minister Fellowships, launched by the Government of India, in partnership with the Confederation of Indian Industry (CII), for their PhD research in the field of advanced porous materials, under the guidance of Dr. Vaidyanathan. The collaborative partner for Dr. Vaidyanathan's project is the Enovex Corporation from Canada.

The fellowship is awarded to promote industry-relevant research in academia and to increase industrial investment in R&D. The first batch of fellowships was awarded to 27 candidates by the Prime Minister on the oc-

casation of the centenary session of the Indian Science Congress (ISC), Kolkata. Two of the four awards in Chemistry were bagged by IISER Pune students.

Under this scheme, PhD Fellows will get almost double the scholarship amount that they receive at present, with sponsoring companies topping up the government scholarship to ₹50,000 per student to do research on the sponsoring company's assignment. As a part of this scholarship, the government awards ₹3 lakh per annum to a PhD fellow while the CII member company also provides the same amount for four years.

IISER is proud of the great achievement of these young scientists, and hopes that there will be more!

## It's Raining Lectures!

Starting from 28<sup>th</sup> January, the IISER Physics nerds got the chance to attend a week-long lecture series on Quantum Field Theory by Prof. Soumitra Sengupta, IACS. It was a brilliant course, appreciated by students of all years. He covered an enormous amount of ground – from quantum mechanics, to Feynman diagrams, even with the time-constraints. Turn to page 5 for his exclusive interview with the Sentience team.

Then in February, Prof. K B Athreya, a wonderful speaker from the Iowa State University, gave five Mathematics talks, and one special talk on Indian *Raagas*. He rigorously discussed many easy-to-understand questions, gradually increasing their complexity.

On the occasion of condensed matter week at IISER Pune, there was a special lecture series from 11<sup>th</sup> to 15<sup>th</sup> February, by Professor Nandini Trivedi from Ohio State University. She told the students about the current exciting research going on all over the world in this field.

For complete details on these, check out our website.

## Reaching Far and Wide

Science media communication has arrived big in IISER Pune. The X-Ray diffraction symposium organised jointly by IISER Pune, NCL and NCCS was covered by Revati Mandage, a 3<sup>rd</sup> year BS-MS student, who received backing from the Media Centre at IISER Pune. The symposium covered several talks and the latest innovations in the field of X-ray diffraction. Initially, the documentary was to be archived and added to the existing collection. However, owing to the national importance of the contents of the symposium, the documentary was telecast on the Lok Sabha channel. It was voiced in English by Nita and in Hindi by Sukruti Bansal, 3<sup>rd</sup> year BS-MS. Revati, who attended K P Madhu's workshop on movie making, sought help from him for the editing and the final touches. She believes that she has a lot to learn and that science media education is the new tool for effectively communicating science. It can change people's attitudes and invoke enthusiasm in 'doing' science, rather than just learning about it.

## Academic Buzz

1. Summer Internship Programme (in Physics) for Indian Students (SIPIS), National University of Singapore

**Duration:** May-July 2013

**Link:** <http://goo.gl/YQrFH>

**Deadline:** End of February

2. SNBNCBS Summer Research Programme 2013

**Duration:** May-July 2013

**Link:** <http://goo.gl/3JJdS>

**Deadline:** 1<sup>st</sup> March

3. Summer Internship at Bose Institute, Kolkata

**Duration:** May-July 2013

**Link:** <http://goo.gl/fcOfQ>

**Deadline:** 11<sup>th</sup> March

4. Visiting Summer Student Programme (Physics and Mathematics), IMSc, Chennai

**Duration:** May-July 2013

**Link:** Physics- <http://goo.gl/xTuE7>

Mathematics- <http://goo.gl/af37n>

**Deadline:** 15<sup>th</sup> March

5. Summer School on Numerical Relativity, ICTS-TIFR, IISc Bangalore

**Duration:** 10<sup>th</sup> June-5<sup>th</sup> July

**Link:** <http://goo.gl/sMh9l>

**Deadline:** 31<sup>st</sup> March

6. Jobs at Earth System Sciences Organization (ESSO), IITM, Pune

**Post:** Scientist (Trainee)

**Link:** <http://goo.gl/zl0v7>

**Deadline:** 31<sup>st</sup> March

7. The Graduate Training Program, India-based Neutrino Observatory, for MSc Physics/BE/BTech graduates.

Also, open short term projects are available for students yet to complete their masters.

**Link:** <http://goo.gl/t5n2H>

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## Sport Up

Photo by: Dr. V S Rao



IPL 2013 Champions, Shaurya '10

Photo by: Prasenjeet Kawale



Vishnu M S, captain of the winning team and man of the series, IPL 2013, holding the champions trophy

Photo by: Vishnu K N



The IPL Runners-Up, The Expendables

The fifth edition of IPL, the most awaited sporting event at IISER, was a grand affair, with 12 teams in the fray. With a loud, cheering and jeering audience supporting their respective teams, the teams too put in their best efforts. As the tournament progressed from the initial league stage to the quarterfinals, the matches became more exciting and high on entertainment.

The biggest upset of the season was undeniably the surprising defeat of Rascals, the two-time IPL champions, at the hands of the Expendables in a nail-biting quarterfinal tie which went all the way to the super-over. Batting first, the Expendables were restricted to a measly score of 67. What everyone envisaged a cakewalk for the Rascals turned out to be their worst nightmare as the Expendables' bowlers, aided by some superb fielding, sent more than half of the Rascals' celebrated batting line-up to the pavilion in less than 10 runs. A gritty innings by Anurag R Mishra helped Rascals salvage some pride, as the match ended on a tie, and the outcome was decided by a super-over. The Expendables' bowlers again showed their class, restricting Rascals to just 5, which they comfortably chased, thereby ending Rascals' dream run at the IPL.

What followed were the semifinal matches, which were mostly one-sided. In the first semifinal, the Expendables comfortably defeated Rebels '09, while in the second, Shaurya '10 routed Biohazard. Then came the final match between the Expendables and Shaurya '10, marked by a crazy crowd with crossed fingers, racing hearts and loud incessant cheering till their throats went sour. Batting first, the Expendables were restricted to 98 in 20 overs, owing to the superb bowling and fielding performance by Shaurya '10. They didn't start well either, and kept losing wickets at regular intervals. This cracker of a game was a nail-biting affair, with both teams giving it their

all and sustaining momentum till the very end. With 12 runs needed off the last over, Siddharth Mohite smashed 2 consecutive boundaries to wrap up the match with 2 balls to spare. Viraj Doddihal played anchor and was judged 'Man of the Match' for his superb batting performance in the finals. At the end of the day, Shaurya '10 emerged as victors of the match and were crowned champions of IPL 2013.

While all players put their best foot forward to help their team surge ahead of the rest in the points table, some shone brighter than the rest with their brilliant individual performances. Pravu Dhal of the Rebels '09, scored an amazing 150 runs in the tournament- the highest so far in the history of IPL, while also hitting the maximum number of sixes and fours, and as a result, he was given the Best Batsman award. Ravi Raja of the Rebels '09 was given the Best all-rounder award for his great performances with the bat and the ball. Vishnu M S, the captain of the winning Shaurya '10, was adjudged the best bowler and the Man of the Series, while the Best fielder award went to Abhishek Khullar of the Shaurya '10. Gaurav Arya was conferred the Outstanding Umpire award.

### IISER at inter-college sports fests across the city

The other sporting teams at IISER also participated in a number of tournaments, including the inter-college sports championship at the College of Engineering Pune (COEP) where the basketball, kho-kho and kabaddi teams played. Our basketball team also participated in tournaments at Symbiosis and ICBM. The Football team took part in the tournaments organised by SCIT, COEP and MIT. At the SCIT tournament, Mohammed Aamir Sadiq received the 'Goal Machine' award for scoring the maximum number of goals and Karma Lobzang Bhutia got the 'Best Goal-keeper award'.

## For the Love of Physics

*Prof. Soumitra Sengupta, the vibrant physicist from the Indian Association for the Cultivation of Science (IACS), Kolkata, visited IISER Pune in the last week of January to give a lecture series on Quantum Field Theory. Here are a few excerpts of his chat with the Sentience Team.*

### **On science:**

Whatever one uses is a gift from science. If there were no fundamental particles which constitute everything, there would be no science. You should try to see nature from the inside, not just from the outside. It is very beautiful. Science invites contradiction and the understanding of fundamental science tells us the truth about the laws of nature.

### **On the challenges faced by a theoretical physicist:**

Science itself is a challenge. Nature often reveals its hidden secrets and challenges us to think. Thus, Science is guided by observation. Theoretical physicists don't have any observations, but we are trying to formulate a theory. You may ask, why... It is not true that Einstein was driven by experimental crisis, indeed he was looking for it.

### **On his current area of research:**

Newton thought that nature exists and we just happen to be its observers - that nature has a law without us. But then Quantum theory taught us that it exists because we interact with the system. This fascinates me.

I have changed my direction many times. When Newton said "I am just picking up a pebble from the seashore", he was not being modest. My favourite area has been particle physics. I also like cosmology, gravitation, black holes, relativity, etc. In particle physics, my further specialisation is in supersymmetry, causality, supergravity and field theory. My research in the past two years has been whether there is an extra dimension.

### **On IISER and its ways:**

I really like that IISER students get to study all the subjects in their first two



Photo by: Sharvaree Vadgama

### Prof. Soumitra Sengupta

years. They need to work harder than the rest of the students from the third year, but they have an additional advantage of other subjects too.

### **On science as a career:**

My classmates did engineering, got hired and left. One of the best decisions I made was to not do that. Because in our field, thinking is free. There is no box. I do whatever I want to and am given a decent sum.

### **On his other interests:**

Music. I learned Hindustani classical for a very long time and I taught it too. So, at one time I was in two minds as to whether I should take up Indian classical music as my profession or Physics. I used to attend all the Indian classical music concerts that took place in Kolkata. I am fond of Western Classical music too.

I also love to see good movies. Really top classics, not the standard ones. I ran a literary club for around 10-12 years. It was so difficult that sometimes I felt that Physics was comparatively easy.

All these activities are good, but most of these do not take place in most colleges and universities in our country. They are "non-academic". Many good students there are not getting the opportunities that you are getting.

### **On travelling:**

I have been to Canada, the UK, the US, Trieste, etc. I was offered a job in Canada. But since I have some amount of

confidence that if you give me a pen and paper, I'll be able to work up to where physics is now, (you have to know the basics) then it is very unimportant where you are. Of course, you should be open. I love to talk to people and I am constantly moving. Because wherever I go, I am a physicist right? So it's not for specific reasons I love Kolkata. But it just so happens that I am there.

### **On the Grand Unification Theory:**

I believe in a Grand Unification Theory. But personal belief should not be mixed with scientific work. My feeling is that there is an underlying symmetry. I'd prefer calling it a universality.

One might believe that God exists and one might believe that God does not exist. Similarly, we want to believe that GUT exists but there is no proof that it exists.

### **His message to IISER students:**

Ask about what you don't understand. Either you will understand or understand where you went wrong. Either way, you will be enriched. At some point, we must muster the courage to question. But always be respectful about others' opinions. Just have love and passion for the subject. That is the part of physics which is not so logical and practical, but is emotional. Effort and sincerity are necessary and you cannot imagine the amount of time you need to give. But you can work hard only at the thing you love. So your emotions towards Physics will be your main push forward.

Try to be collective. Don't try to do it alone. Because it's possible that different people have different strengths but when we come together then it becomes  $n$  times the strength and everyone will learn something from everyone else. Be open to learning; be frank. There will be people to help you and tell you how things work but you must be as creative as you can be. I am very hopeful about IISER, IISER Pune particularly. I have been to the other IISERs, but IISER Pune really gave me a very good impression and I'd love to be back here.

## Rising with Raagas

Shree Sruti V R

It all started with the planning for the Jan Fest and the administration's kind decision of letting us host the overnight concert at IISER. For all the first-years, this was their first experience at an overnight concert. Quite a few of them had pulled off an all-nighter alright, but none of them had stayed up all night listening to music of this kind. So I wouldn't be wrong in saying that the first-years were very eagerly awaiting the experience.

The responsibility of making arrangements for the concert was handed over almost entirely to the first-years, with the seniors watching over us, giving us advice and guiding us along the right path. As we ran around, making necessary stage arrangements, deciding the decoration and even estimating a budget, we learned many a thing about the efforts that go behind the stage to make a concert the success it turns out to be.

On the night of the concert, the atmosphere was filled with excitement as large groups of people poured in. The registration desk was abuzz and people were running around, frantically making last minute arrangements. There were even people put on "Chappal Duty" to make order out of the chaos that was the footwear. Volunteers were dressed in crisp and traditional attires, a yellow SPIC MACAY volunteer card pinned to their chest.

Photo by: Sharvaree Vadgama



Smt. Kalapini Komkali



Pt. Rupak Kulkarni and his accompanists

Photo by: Sharvaree Vadgama

Everyone was in high spirits, full of excitement and enthusiasm to experience something new.

The overnight concert was inaugurated by Dr. N Rajam, an expert equally well-versed in Hindustani and Carnatic music. As her fingers danced across the violin, sounds so sweet and so captivating were produced, that most had not heard the likes of before. With age and experience on her side, she presented a concert which was so moving, that it made a crying baby stop its sobbing and sway its head to the music. She was accompanied on the *tabla* by Shri. Ramdas Parsule.

The second artist for the night was Pt. Ajay Pohankar. He commanded the respect and attention of every soul sitting in the room. He was truly an artist whose age reflected his experience. He presented a flavour of many different styles of different *gharanas*. He sang a *bandish*, a *thumri*, and also a *ghazal*. He captivated the audience, holding them rapt for the entire duration of the concert. Many a soul was sorry to let him go at the end of his concert.

Third on cue was Pt. Rupak Kulkarni. Dressed to impress in a bright pink kurta and an orange overcoat, he captured the attention of the audience right from the first moment. He was accompanied by Shri. Aditya Kalyanpur on the *tabla*, an extremely talented artist in his own right. Rupakji enchanted us with the sounds that came from his flutes of different lengths.

With funny witticisms in between the pieces, he played for us two Carnatic *raagas*, *Raagam Vachaspati* and *Raagam Binna Shadja*, which were a midnight and an early morning *raaga* respectively. One of our friends even got a chance to play the *tanpura* on an iPad! In the end, he left us very much awake, and in a state of elation.

The last concert of the night was by Smt. Kalapini Komkali, who was accompanied by Shri. Prashant Pandav on the *tabla* and Shri. Suyog Kundalkar on the harmonium. She sang a few less-heard *raagas*, amongst which was the exceptionally rare *Raaga Lagan Gandhar*. With her robust voice, she brought about the perfect end one could have hoped for with a *bhajan* in *Bhairavi*. All throughout her concert, the two accompanists added depth to her singing and brought out the best in her music.

The entire concert was a brand new experience, not just to the volunteers, but to the crowd as well, who had filled the hall to the extent that it was bursting at the seams well before the concert had started. Though the numbers dwindled as the night progressed, there was still a significant number inside the hall. When the concert ended, at around 5 am, the audience left the hall with an unmatched experience and the volunteers let out a collective sigh of relief of a job well done. After a quick round of packing up, the tired but happy volunteers walked into the beckoning arms of their beds.

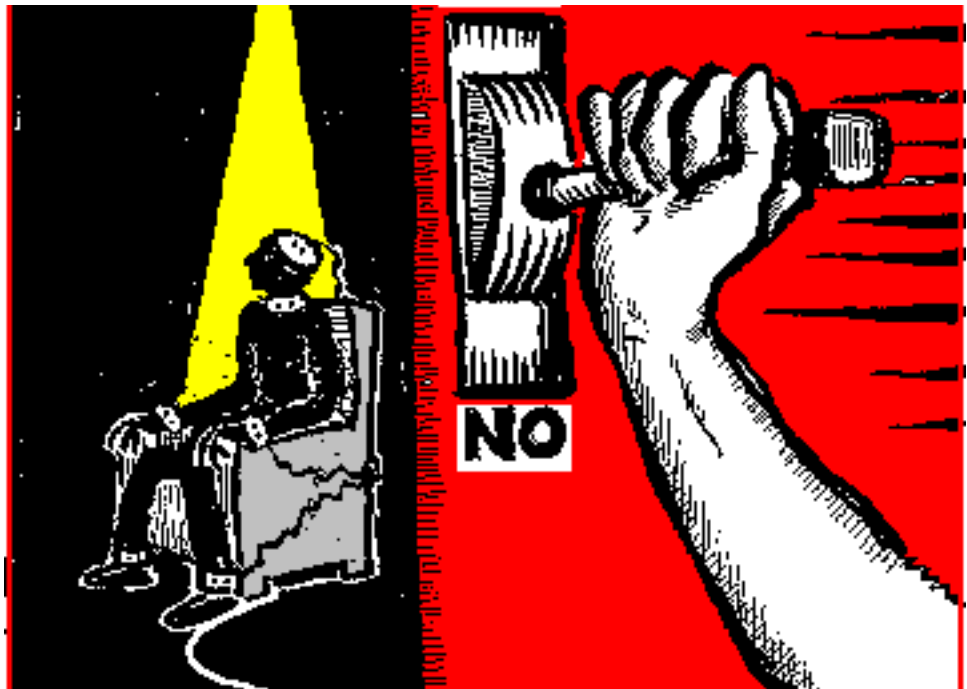
## License to Kill

Papia Bera

In the year 2001, in a whirlwind of media, India woke up to find its parliament attacked. On the 13<sup>th</sup> of December, five terrorists, affiliated to the groups Lashkar-e-Taiba and Jaish-e-Mohammed, attacked the building housing the Parliament of India. They were killed, but along with them, nine security personnel and one civilian also perished in the attack. Following this, swift action was taken by the Delhi Police, who arrested Afzal Guru from Kashmir, S A R Geelani of Delhi University's Zakir Hussain College, Afsan Guru and Shaukat Hussain Guru as soon as two days after the event. Even our usually lethargic judicial system managed to conclude the Parliament attack case in less than a year's time, finding all the four accused guilty under the Prevention Of Terrorism Act (POTA), 2002. Afzal Guru was given a death sentence, whereas the rest were convicted to varying years of rigorous imprisonment. The prosecution proved beyond any doubt that Afzal Guru was instrumental in providing the terrorists with a hide-out and accommodation while in Delhi. He also helped in arranging the logistics and execution of their plan. This judgement of the court was seen by many as retribution, as the rightful punishment they deserved.

More than 10 years have passed, and while Shaukat Hussain Guru and the rest have already been let out of Tihar jail on completion of their sentences, Afzal Guru's case, after four rejected mercy petitions, was finally put to rest when he was hanged on February 9<sup>th</sup> at 8 o'clock in the morning. The hanging was done in top secrecy, and not even his family was informed until two days after. All this was apparently followed to prevent any violence in Jammu and Kashmir. His body, which was not handed over to his family, was buried in the jail complex.

This sudden decision by the government to hang Guru, closely following the execution of Ajmal Kasab in November, has raised many speculations among Indian citizens. In Kasab's case, neither his family nor the Government



of Pakistan were willing to claim his body to perform the final rites. This sudden trend of frequent and almost careless use of capital punishment for crimes in India has left many worried. All over the world, the words "death row" are used cautiously, almost fearfully. According to Amnesty International, as of May 2012, 141 countries have abolished the use of death penalty either in law or in practice. Most that still have the death penalty almost never use it in practice. China has the record for the maximum number of executions per year even though they remain shrouded in secrecy.

This worry does not arise just due to the debate over the value of life, but more due to hasty decisions taken in cases where there is so much external pressure on the judiciary arising from the media, and also the enraged and strained voice of the people. In the parliament attack case, during the year-long trial, the special POTA court announced that the men must be given the harshest of punishments. This decision was taken even though Afzal Guru was the only one with enough strong evidence against him, and the others were merely under 'judicial suspicion'. In fact, none of them were directly responsible for perpetrating the outrage.

It is odd that even as the interna-

tional consensus for the abolition of the death penalty increases, in India, the scope for applying it has increased over the years. The most recent example of this, of course, is the revival of Terrorist and Disruptive Activities (Prevention) Act (TADA), 1987 through the passing of POTA, a legislation that was modelled on the lapsed law and is disturbingly similar in many ways. Criminals deserve to be punished and, if their crimes warrant it, with severity. But even harshness has its limits, which are dictated by concepts of justice and a respect for human life and dignity. And as long as effective alternatives to capital punishment exist, there will always be doubts about its use as an instrument of social policy.

The use of the death penalty is a remnant of a bygone past, a relic of the bloodthirsty times that the world is striving to leave behind. It had its uses in times when fear amongst the masses was the way to rule; it has no place in a government that stands by democracy and even less in one that is bogged down by red tape as well.

### References:

1. <http://www.amnesty.org/>
2. [http://en.wikipedia.org/wiki/2001\\_Indian\\_Parliament\\_attack](http://en.wikipedia.org/wiki/2001_Indian_Parliament_attack)

## Building Trees

Aditya Katti

**D**endrimers are large and complex molecules with well-defined three dimensional, symmetric and branched structures named after the Greek word 'dendron', meaning tree. These molecules were first synthesised in late 1970s and the field has advanced tremendously since then with more than 10,000 papers by 2008.

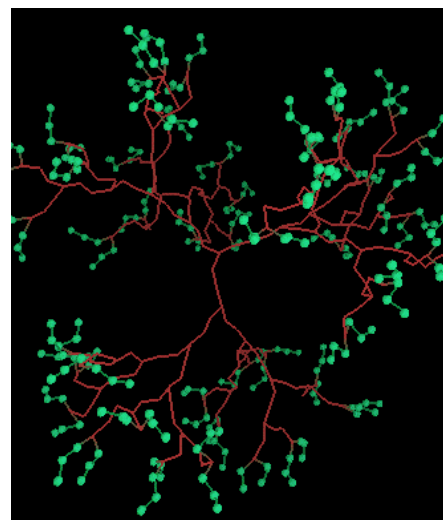
Dendrimers consist of three major regions namely core, repeating units called branches and peripheral end groups which are the sites of chemical reactions. There are two main approaches for synthesising dendrimers- the convergent approach and the divergent approach. They are produced by an iterative process, where each step gives rise to an exponentially increasing higher-order dendrimer product. One of the most useful aspects of this technology is that it is relatively easy to control their size, composition and chemical reactivity very precisely.

One of the first synthesised macromolecule of its kind was the PAMAM dendrimer which is an acronym for Poly AMido AMide dendrimer. PAMAM dendrimers are synthesised divergently, i.e. by starting with a central monomer unit and adding molecules around it to obtain the desired size using ammonia or ethylenediamine as initiator central molecule or core reagent. A double Michael addition of methyl acrylate to a primary amino group, followed by amidation of the resulting carbomethoxy intermediate with a large excess of ethylenediamine, are the iterative sequence of steps for the production of

these dendrimers. These dendrimers are produced up to the tenth generation and to about a molecular weight of 930,000g/mol. PAMAM is often called 'artificial protein' because of its systematic and dimensional length scaling, electrophoretic and other biomimetic properties and is extensively used in immunodiagnostics and in-vitro gene expression applications. Many dendrimers have been synthesised since then with multiple applications in different fields of science.

Dendrimers have interesting applications, in pharmaceutical and biomedical fields. The molecules are small enough to pass into cells and are used in delivery of drugs, genetic materials and chemical markers right into the cell. They can be created to be biologically active or inert which helps in performing different functions in the cell. On a simpler level, the ability to engineer all sorts of behaviours and properties into dendrimers is really promising in the field of biotechnology and has many medical applications. For example, dendrimers are used as transfection agents (carrying and incorporating foreign materials into cells), for mediating transport across cell membranes, or for binding particles to inhibit an immune response.

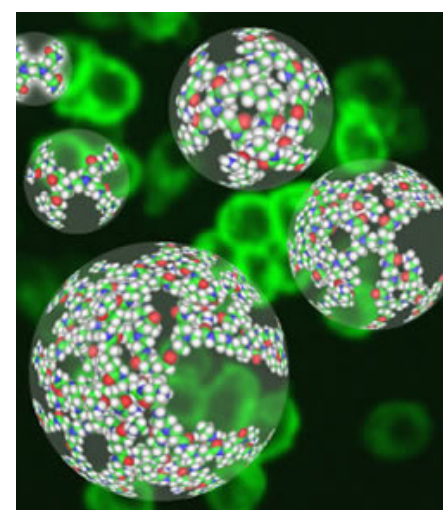
Dendrimer structure is also dependent on the imagination of its creator, the optimality of its function and the economy of its production. This field is your mind's playground; you can create any molecule according to your whim!



A potential blood substitute dendrimer

### References:

1. [www.dendritech.com](http://www.dendritech.com)
2. [www.sciencedirect.com](http://www.sciencedirect.com)



Dendrimers along with cells in vitro

## Smells Like Science Spirit

### Continued from page 1

different subjects viz. Physics, Biology, Math and Chemistry, and their intersections, IISc Bangalore emerged victors by a huge margin. Following them were NISER, Bhubaneswar, BITS-Pilani, Hyderabad and St. Xavier's college, Kolkata, in that order. At the end of the two-day quizzing marathon, the teams were completely spent. So were the 60-odd volunteers who did all

kinds of jobs from question-making to filling water bottles to chocolate regulation. As the final credits were run on the screen, accompanied by the Mission Impossible theme, much cheer spread through the room.

The teams were very appreciative of the organisational, intellectual and creative efforts of Team Mimamsa. Even the hard-to-please head, The Chief Warlock of the Wizengamot, Dr.

Sutirth Dey, seemed quite pleased with most of the event. At the end of the day, the greatest achievement was how the teams became very close to their 'rivals' as well as the volunteers and how friendships were sealed over a game of handball.

For the questions, answers, forums, photos and behind-the-scenes action, please visit <http://www.facebook.com/mimamsa13>.



This holiday season, Sentience sits down in the midst of a snow-storm of teddy bears and marshmallows and looks at the density function of love at IISER. The professors are all loved more than they should be, villagers in remote locations feel loved by our fellow-folk, kids in tribal villages in Naxalite areas are touched by our love, children in slums around feel loved by us, the kittens, the puppies, the random snakes in the campus all share huge chunks of love from the mass of the IISER population. Yet, the graph seems irregular, for we are missing out on a few significant souls, even within our tower of existence: the iPhD students. The bachelor student population seems to be anaphylactic to the PhDs, and this is quite an Integrated feeling. This is a sentiment not entirely unrequited.

The iPhD positions at IISER are much sought after, possibly owing to the absurdly low number that would gain admission. The bachelors have a love-hate relationship with this group as they represent all that they can never be; hailing from a hard-core Science background, treasuries of arcane facts and seemingly useless equations, favour-holders of every single Professor, and owners of sets of new and ironed clothes. It is a well-known fact that much of the serious research done below the PhD level comes from the iPhDs, while the rest just slack off and submit reports. However, behavioural analysis has revealed that this is pretty much the full extent of their activities at IISER. As a result, love has been disproportionately distributed to various bacteria, chick embryos, real and complex analyses, nano particles, organic and inorganic materials and the energy in the universe while the finer arts remain dusty and cob-webbed. Considering the fact these students hail from diverse academic backgrounds and many of India's premier institutes, they would have been exposed to the real campus culture and college life. Intuitively, they would be of value to the organisational and operational groups of the multitudes of clubs at

IISER, both functioning and defunct, which are still predominated by the BS-MS masses.

The BS-MS characters, on the other hand, exploit the true meaning of college life - clubbing (at IISER) and partying (kicking people on birthdays) and smoking the hostels up (cooking Maggi, of course). Most of us come with an immense passion for science, innovation and a burning curiosity for everything. Caught in the murk of Sentiences, Kalpas and Karavaans, our academic education, despite the flexibility of choice and good courses, decays to frantic slide-viewing on the eve of exams. At the end of the day, you

“The bachelor student population seems to be anaphylactic to the PhD's and this is quite an Integrated feeling.”

know less, you crave for more and are left with a feeling much like the lingering taste of a hangover in your mouth. Summer projects are spent travelling and holidaying and semester projects are spent shirking meetings with the mentor and skulking from their presence. In the end, we are all masters of forgery fit only for government jobs, where survival demands such skills. It just might be that we are jealous, envious of our peers, who seem to be further along in their lives. They have no tough life decisions to make, no more applications to send out after five years of full-fledged college life and no imminent uncertainty hanging like a sword above one's head. They have chosen and they seem content. This knowledge and the ill-feeling that comes with it has prevented the natural inclusion of iPhDs into mainstream IISER.

A sense of belonging to the institute comes as a result of being part of the organisation and taking active roles in management of activities. Once upon a Karavaan, the PhD students of IIS-

ER (who find more time, surprisingly) had put up a musical, commendable for the efforts and the casting. Since then, only a few lone singers or actors or a juggler (who is a Professor) have graced the stage. The scene is similar in the other avenues, except for the active Chemistry Mimamsa team and IPL. Despite scores of persuasive and imploring e-mails sent every week, the earth below the music club, Kalpa and Disha, to name a few, remains untrod-den by dedicated scientists. The exclusion of the iPhDs is thus a two-pronged affair and the absence of a coalition is a crooked angle in the IISER social framework. The classic solution would be for increased interaction between the undergrads and the others (beyond awkward conversations to break the silence and claustrophobia of the lifts) leading to a higher participation in non-academic activities. The dusty and dormant Science Club seems the perfect arena to begin as its downfall was marked by the absence of speakers willing to talk about their research. The iPhD and PhD population would have enough data to present at such a forum. This would be a very useful exercise for everyone, including the presenters as it would give them confidence and practice at thesis defence. It is important that we do not let the pipettes suck the love for life out of the scientist!

Being part of the traditional IISER activities brings about a level of acceptance, beneficial for everyone. IITs are famous for their raucous spitting and sparring across the bachelor-graduate divide. If care is not taken, the IISER situation might degrade into quite a vicious cycle. This Valentine month, Sentience proposes a novel way of getting to know your PhDs and iPhDs, to break the imaginary walls that close in around the different factions, to throw a little love around, to make IISER a better place to live in, the Michael Jackson style. Join our campaign and Hug a PhD today!

Sentience invites PhD and iPhD contributions to [sentience.iiserpune@gmail.com](mailto:sentience.iiserpune@gmail.com). Sit down and be heard.

## The Refrigerator And The Universe

Prashali Chauhan



The artists behind the curtains are the laws of thermodynamics, silently drawing the strings of the huge drama that the universe is.

Almost everyone has studied thermodynamics at some point in their lives, but only a few recognise the significance its laws hold in our world. Everything around us follows the same principles of energy and entropy, and even something as insignificant as burning paper makes a difference in the cosmological makeup.

In this book, the Goldsteins take us on a journey through the birth of the universe, its expansion, our coming into existence and the story thereafter. They explain beautifully how a device as simple as the refrigerator has all that it takes to explain the fate of our universe.

The first law states that energy remains constant in any closed system. Our universe is a closed system, which

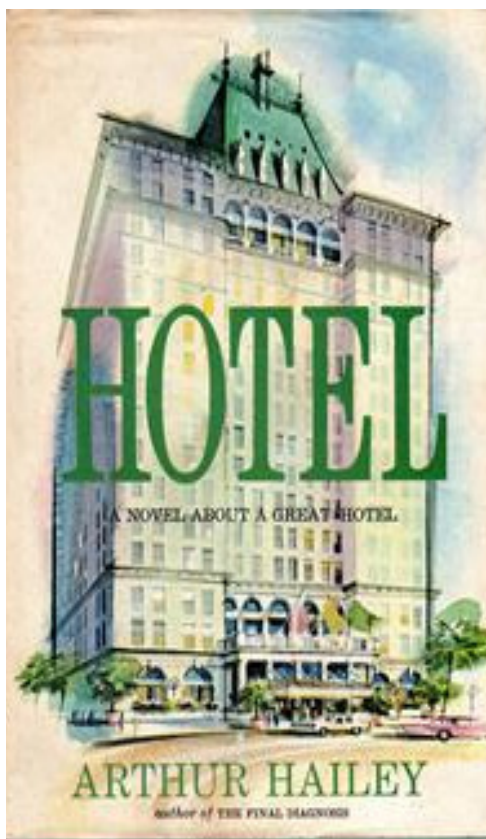
means that energy should remain constant, though its form may be different.

Imagine a burning piece of wood, it turns into ashes. Gradually the air with carbon dioxide begins to settle on those ashes, it warms up and then breaks into a flame. As the flames die down, wood is formed and our log is back. No one would believe it's possible. Yet nothing has happened that violates the first law, all the energy can be accounted for. Then what difference did it create?

Here we introduce something called entropy which decides the direction of flow of events. This entity plays a decisive role in the current model and future of universe. The book explains all this with a great deal of accuracy without holding out the limitations faced today. Though slow in the beginning, it absorbs the reader into its own world.

## Hotel

Harini Suri



Hotel is Hailey's most popular work. It has a bit of everything for everyone – thrill, suspense, love, sincerity and conspiracy. This book inspires the reader to read up more on the topic, even after the book is done.

Written in the setting of a hotel in New Orleans, the novel brings to light the many dimensions of human relationships. The story revolves around the hotel which is facing a financial crisis and how it is put back in business.

St. Gregory is one of the few old-style independent hotels in the neighbourhood, preferred by visitors from around the country. While it had a good reputation in the past, the hotel has lately become full of corrupt employees - from those at the top of the system to the 'bottom-level' workers, who are forced to be dishonest due to the crooked Bell Captain. Peter McDermott, along with the proprietor's secretary, Christine Francis, are

the only people who try to restore the hotel to its former glory. Despite having a black mark on his past career, McDermott is a well-educated person, quite capable of running the hotel. He has a very good rapport with all his employees, as he welcomes their ideas to develop the hotel.

The hotel's financial problems put it under the pressing threat of foreclosure, as it is mortgaged to the hilt, while rumours grow that Curtis O'Keefe, the owner of a chain of hotels, has arrived to take over St. Gregory. This just adds to the problems.

With a multitude of intertwining plots, the book offers the readers every flavour they could want from a book. Hailey leaves his mark with his in-depth research in the field and, with his story, inspires the reader to continue reading his books. This book makes a very entertaining as well as an informative read. It's surely a must-read for every bookworm!

# XPRESSION

## Be a Good Sport

Sahana Srivathsa

In the midst of all this IPL fervour, I couldn't help but notice the vast disparity in the encouragement for different sports, specifically cricket, in comparison to the rest. This may sound like old news or a reiteration of the same old grievances of how not enough money is being spent for developing other sports in India. While I do wholeheartedly agree with these sentiments and bemoan our country's performance in the Olympics, I thought I would stray off the well-beaten path and comment upon the state of affairs slightly closer to home.

As a sports fanatic, willing to play or watch just about every sport ever played, the first thing I investigated upon arriving on this campus were the sports facilities. Needless to say, I was sorely disappointed, though in the last couple of months, with the new basketball court, badminton court and volleyball net, my spirits and hopes have risen. However, till the end of last semester, considering the 600+ population of IISER students, the athletic activity on campus scarcely made a mark. The scant few basketball players had to travel more than a kilometre just to play on half a court in the deserted premises of HR1, while the volleyball enthusiasts practised in front of HR4 with constant interruptions by vehicles and people. The footballers required all their zest for the sport to play on the uneven, undefined, versatile expanse in front of HR4, while badminton mainly consisted of post-supper playoffs at the entrance to HR4.

With the advent of IISM, IISER saw a sudden flurry of sports activities at the end of last semester, from both the students, most of who practiced with religious vehemence, and the institute, with the miraculous appearance of the basketball, volleyball and badminton courts, as well as their extreme gen-



erosity towards funding for the entire IISM. Despite the Sports Club having the maximum number of members, cricket still seems to be the one sport played by most IISERites and IPL is still the largest sporting event. Not that I have anything in particular against cricket as a sport, but the insanity that is associated with it in our country, and sadly to some extent at IISER as well, to the limit where other sports take the back-bench, is something which I oppose. In the IPL frenzy, the footballers lost their playing field unceremoniously and were forced to the streets and the basketball court. The amount of effort expended for cricket, while exemplary, should be shared amongst the other sports.

With all our new sporting facilities, one would expect to see a greater number of the student population up and playing. Unfortunately, the numbers out on the fields and courts still remains pathetically low. However, startlingly enough, all the recent developments in athletic infrastructure have inspired the college teams to participate in inter-collegiate Sports Meets (especially football and basketball), and with their commendable performances it's only a matter of time before IISER Pune starts bagging medals outside the academic arena.

My loudest lament, however, is the enormous gender gap prevalent uniformly across all sports, without exception. While women may be considered

the "weaker sex", and even taking into account the 2:1 ratio of guys to girls at IISER (which incidentally is much higher compared to many engineering colleges which have girls' teams in addition to boys') the lack of ladies gracing our dusty and muddy fields is atrocious. Toughen up, pick up a racquet or a ball, tie your shoelaces and head out onto a court, forget about how well you play, just enjoy the game!

Regardless of all the excellent facilities being provided at IISER, it's interesting to note that even with many cycles scattered around the campus, not a single air-pump is to be found anywhere on the premises. Those in dire need of a working cycle or a usable ball have to resort to a prolonged journey in search of one (to a few unorthodox places as well). So be it football, basketball, badminton, volleyball or even cricket, the next time you find yourself with time on your hands in the evening, don't turn to your laptop and hard disk for a movie marathon, and instead go try your luck, learn a sport and fill up the fields and courts!

### UPCOMING COLLOQUIA@ IISER

1. Prof. Sriram Ramaswamy  
**Date:** Science Day, 28<sup>th</sup> February  
**Title:** Motile matter and other problems at the physics/biology interface
2. Dr. Ashish Lele  
**Date:** Science Day, 28<sup>th</sup> February  
**Title:** From Molecular Structure to Polymer Processing: Bridging length and time scales
3. Prof. Raghavendra Gadagkar  
**Date:** 13<sup>th</sup> March  
**Title:** A model for evolution of cooperative nesting and altruism in primitive eusocial wasp *Ropalidia marginata*

# PRESSION

## Pandeyyyy

The Bearded Wanderer

As I sit here in the library, reading the latest issue of *Sentience*, I must say I am eager to see the next one. I wonder patiently, imagining impatiently what lies beyond IISER. IISER, as a tree with a life of its own, is becoming apparent to me as I consecutively read the previous three issues of *Sentience* again. To add to it my own contribution, I begin. But beware readers, unworthy of delivering anything meaningful, I will not be telling you anything new, but shall only reinstate what now remains of "Pandeyy".

With as much pleasure as in the heart of the little boy who beholds the beauty of the serpent he just beheaded, that shall I say, is the pleasure of shouting "Pandeyy". The oscillating sound in the hearty, lung-bursting stretch of the ending 'eyy' in "Pandeyy" is just so liberating, that one can only try to explain it in words.

The "Pandeyy" is not a person (though obviously they say it is the name of a guy currently in BS-MS fourth year). It is, more than anything, a symbol of relief. Relief from a stress, which, at its best, is proficient enough to cause you to climb a cliff and die after free-fall. To be able to let that frustration inside you fall away, is personified and then pronounced as "Pandeyy". "Pandeyy", in its darkest forms of existence, lives in the minds of all those who regret their current habitat, regret not having any peace of mind. To the end-result that this thought of theirs itself takes away the 'peace' that one can find. At a fundamental level, the cause

of this release of "Pandeyy-ing" emotions, I have not been able to find yet. But I must extrapolate, sounding like a leap of faith, that this behaviour of men only reflects the stays of behavioural psychology of at least the entire Indian subcontinent, if not of all developing countries, evolutionarising materialistically. The current attitude of our country's citizens, as it evolves with time, is only getting better materialistically and deteriorating spiritually.

Only this much have I been able to find. To speak more shall risk that my filthy puns enslave the beauty enraptured by the symbol of "Pandeyy". I shall not risk having my readers getting disturbed by the deepest implications of this mere word. A liberating word from your heart, aloud, proud of its insane pain, poured into a sober symphony, the symphony which often annoys many sincere stud-mugs in the hostel-void ("Pandeyy" seeks sincere apology for that). I, bound by my own addiction to exaggeration, shall now refrain from saying anything more about "Pandeyy".

**Note:** "Pandeyy", as one may question, remains faithful to the feelings of the fourth-years. For the other perverted parodies like the patronising "Mateyy", etc., the sentimentalism obviously lies in complete contrast. As far as the decreasing popularity of "Pandeyy" is concerned, when time calls for it, I am sure "Pandeyy" will be reincarnated.

## IISER's Mugged!

Slowly but surely, the long-dormant Environmental conscience of IISER students is coming to life, and has found an outlet in a bunch of students who started up the IISER green club, Prutha. In association with *Sentience*, Prutha has made available mugs with witty designs, in order to reduce the paper cup usage at IISER's cafeterias. People are

lining up in large numbers to buy the *Sentience*-Prutha mugs, now available at the new hostel canteen. Fear not, O Absent-minded geniuses who didn't register for one! Solely on first-come-first-serve basis, a limited number of mugs are available, at only ₹120, to those who did not register! So, buckle up, laggards, and race to the cafeteria!

## Foodie Corner

AASHAY PATIL

Sometimes, when you wish to experiment and try something new for dinner, it's a good idea to visit a global cuisine restaurant. The nearest good global cuisine restaurant is **Zikomo** at Baner. It has a selection of a wide range of Maharashtrian, Italian, Mediterranean, Continental and Asian dishes.

The best items to try here are undoubtedly the Continental dishes. But don't just stick to the traditional pasta and pizza here. You will be spoilt for choice, owing to their expansive menu of both vegetarian and non-vegetarian dishes. Feel free to experiment and try a few weird-sounding dishes. The Indian dishes, although good, are not recommended, as there are better places to try these. And don't even think of trying the Maharashtrian items here. This is not a place to have *Zunka-Bhakar* or *Dalimbyachi usal*!

However, the quality of all food items is top-notch. The ambience is great, with light music and dim lighting, but the service is a bit on the slower side. It is slightly expensive, with a 3-course meal costing approximately ₹400 per person. In spite of this, if you want to spend a relaxed evening with your friends, Zikomo is worth a visit at least once.

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