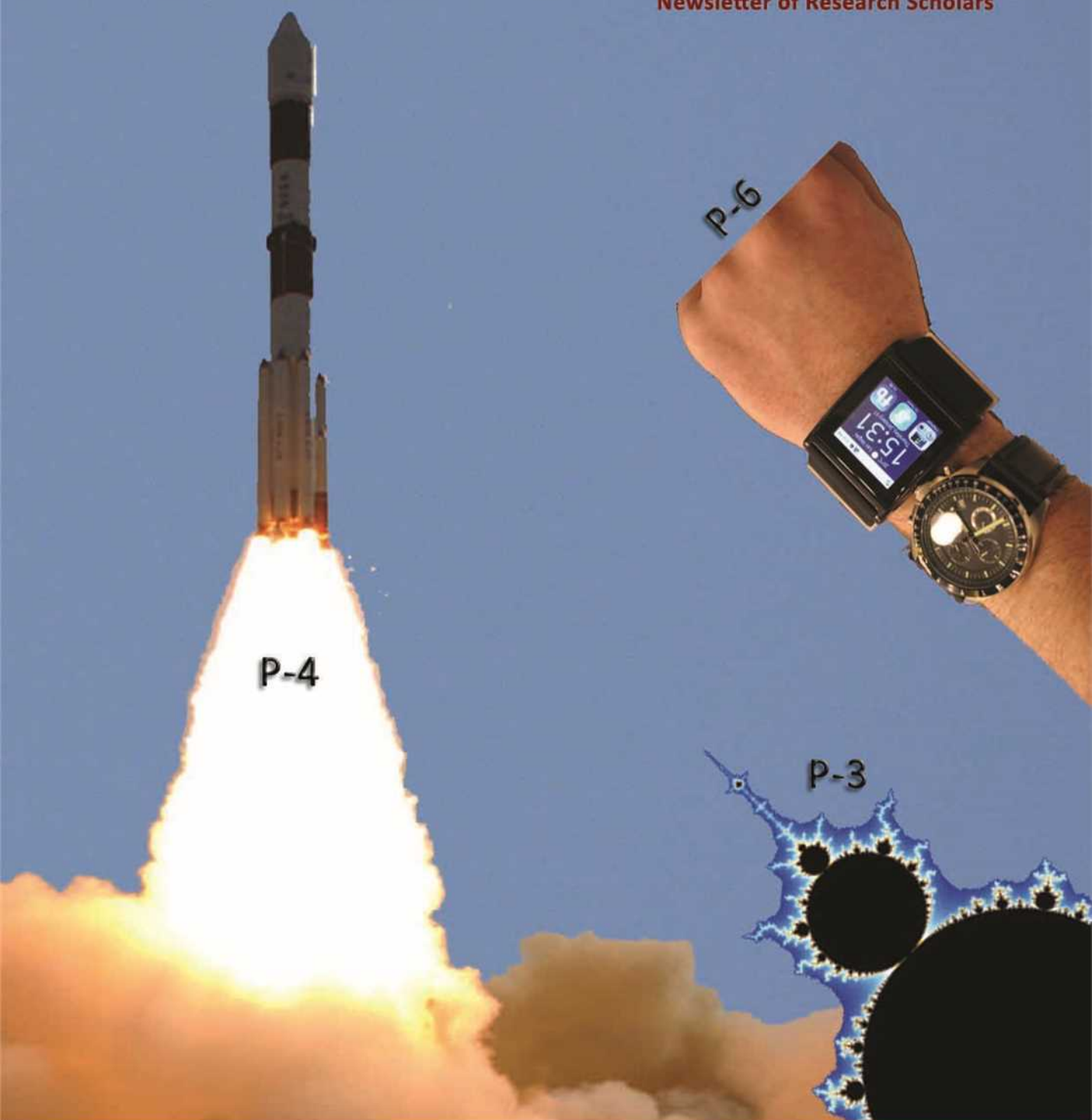


November
2013

|| Volume 2 || Issue 7 ||

ReNews

Newsletter of Research Scholars



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Disclaimer:

The views presented in ReNews in the reader contributed articles may not essentially represent the views held by the ReNews team. The authors of those articles are solely responsible for their views.

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The Editors' Speak

The month of November has been very eventful for team ReNews. The editorial team takes great pleasure in welcoming Guru and Aditya, the new correspondents, along with Samik who joined us as an editor. We thank Malini for her efforts as an editor in helping us reach where we stand today. We were able to keep the promises we made to our readers last month. *Researchers' Inc.* has been introduced to highlight the research work across various labs at IITM. On similar lines, Suyash has started *Tech-o-philia*, where he brings out the story behind some of the most recent technological innovations. Malini presents a report on BIOMERS organized by the Department of Biotechnology. Our insti celebrated the golden jubilee of *Chaos*. Our correspondent Bajwa reports that the event was marked by a rather lucid talk on the origin and development of chaos theory by Dr. Balakrishnan. Thanks to Vasanth, we are able to listen in to a curious conversation between *Phobos and Deimos*, who are discussing the maiden Indian Mars mission *Mangalyaan*.

The regular columns have been kept intact. The RAS talks about placements and the new regulations brought in by the senate. Karishma and Alekhya talk about *glial* cells and their role in aging through an interesting conversation between Dr. Brown and Marty. Prajakta reviews *What is Life?* by the legendary *Erwin Schrödinger*. Aditi tells the story of an eternal wait through her poem - *Pakhi*. Varun captures beautiful butterflies on campus. Mathieu Ferry tells about life in IITM, his views on India and its cultural heritage. We received two contributions from readers. Suresh writes a heart-touching piece - *Connateness*. Rahul tells us about his experiences as a novice venturing out to write his first article.

We thank all the readers out there for their unwavering and sustained support. We would also like to inform you that the team is always open to suggestions and criticism, more so if it is the latter since criticism, as they say, always opens up new avenues to explore and improve. Please do send us the metaphorical bouquets and/or brickbats, whichever it might be!

You can reach the team at:

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Ranjan Piyush

Ranjan Piyush



Samik Malla

Samik Malla

ras desk

November brings an end to another eventful semester. It also starts to a month of hope for all the final year students sitting for placements. Wishing all the best for all the students and scholars sitting for placements.

The month of December also happens to be the most pleasant month of the year in Chennai. There will be a lot of conferences scheduled in our campus during this month. These conferences are an excellent platform for all the research scholars to network with the big shots in their field and also learn about new areas of research. Scholars are encouraged to attend these conferences.

The Library Advisory Committee recently met and updated stats on the new books purchased and journal subscribed by various departments. Few departments are yet to utilize their allotted share. Scholars who require a particular book to be brought for their re-

search work may contact the LAC members through the guides.

The Senate recently approved a few changes in the procedure for up-gradation from MS to PhD. MS scholars may upgrade to PhD once they obtain a CGPA more than 8 on completing 5 courses. Their previous rule of a minimum period of one year has been dropped. The other important change is that a MS scholar can appear for Comprehensive Viva before they convert to PhD. Once they clear the Comprehensive Viva they will have one month to convert to PhD.

Finally wishing all of you happy holidays.



Oswald Jason Lobo
PhD Scholar,
Mechanical Engg
Research Affairs Secretary

awards & honors

Suraj Vallamakonda and **Sripriya Kalidose** from the Dept. of Mechanical Engineering were awarded the prestigious **Nissan Foundation Scholarship**. The award was given away at a ceremony held at the IC & SR building, IIT Madras.

Writing Octopus' (a collection of poems) by **Prof. K. Srilata**, Department of Humanities and Social Sciences has been published by Authorpress, New Delhi. The book was released on November 9, 2013.

Prof. T. Pradeep, Department of Chemistry has been appointed as a Member on the Editorial Board for the journal, **Chemistry – An Asian Journal**, one of the sister journals of *Angewandte Chemie*, for a period of 4 years from 2014. Also he has been elected as a **Fellow of the Indian National Academy of Engineering (INAE)** by its Council in recognition of his distinguished contributions to "Engineering". The Fellowship will become effective from January 1, 2014.

Prof. A. R. Balakrishnan, Department of Chemical Engineering has been elected as a **Fellow of the Institution of Engineers (India)** with effect from September 23, 2013.

A book entitled *'English for the Hotel Industry'* by **Dr. Aysha Iqbal Viswamohan**, Associate Professor, Department of Humanities and Social Sciences has been published by Pearson, New Delhi.

A textbook entitled *'Elementary Flight Dynamics with an Introduction to Bifurcation and Continuation Methods'* by **Dr. Nandan Kumar Sinha**, Associate Professor, Department of Aerospace Engineering coauthored with Dr. N. Ananthkrishnan, IIT Bombay has been published by CRC Press, Florida, USA.

50 years of Chaos: 1963 - 2013

Chaos, the ultimate manifestation of irregularity, randomness and everything undeterminable. Well, not quite, as was lucidly explained and demonstrated through a series of handwritten slides by Prof. V. Balakrishnan at CLT on November 23rd. Here are a few excerpts of the talk and the element of awe, the revelations of chaotic systems stirred up in the audience present at the talk.

The talk primarily emphasized on the theoretical basis of dynamics and 'at times' the shaky grounds on which it stands, owing to the difficulty that the researchers face while coming to terms with what really dynamics refers to! As stated by Prof. Balakrishnan dynamics in a trivial sense can be thought of "An evolution of a particular system in time." He shed some light on the historical background of dynamics and the important breakthroughs that have led us to its present understanding. The equations of motion given by Galileo may as well be regarded as the cornerstone for development of dynamical systems in an organized manner. Another important consideration was the bifurcation of dynamical variables into discrete and continuous terms. The process of experimental investigation initiated by Galileo made him the significant forerunner of change. As it happened, Newton followed suit with his widely popular yet counter-intuitive notions about dynamics. He took the subject to soaring heights. He put forward the idea of action at a distance but locally governed by differential equations, well supported by his own works in Calculus (or theory of fluxions as he called it). An important aspect of his work was the idea that the present determines the future and not the history of how the present state was achieved.

Moving on from the historical perspective, Prof. Balakrishnan explained further that dynamical systems move in phase space instead of the free space.

As is evident from present day's work on dynamics, one rather interesting way to describe time is that it is the arena on which the drama takes place. Prof. Balakrishnan substantiated his views on chaos by illustrating the plots of periodic motion described by closed phase trajectories. The points at which stable or unstable equilibrium occurred are in a sense regarded as 'tipping points' in modern literature. And it is at these tipping points that the seeds of chaos lie. Albeit these are the points around which neighboring conditions differ drastically.

The discussion shed some light over the 'strange attractors' which laid the very foundation of the study of chaos in dynamical systems. Though Poincare had tried studying similar systems, as the one described by Lorenz in 1963, pretty early in the 1800's but failed owing to the complexity of the subject and due to the limited computing techniques available at that time. 'Strange attractors' make use of a hefty number of mathematical techniques, viz., fractal dimensions, bifurcation theory, singularity theory, hierarchy of randomness in space etc.

The understanding of Discrete-time dynamics came into existence due to the Bernoulli shift/map experiment. As the lecture progressed, statistical methods to analyze systems were discussed and led to the idea that universe is in general periodic and because of the interconnectivity of systems it is not possible to isolate influences. An example of locked systems can be Pluto locked into orbit with Titan. The lecture was concluded with the mention of Lorenz attractor and it is this finding that brought chaos to the attention of mainstream academia. We can safely say that complex dynamics is of chief concern to the present day physicists and if asked to describe 'what chaos is?' here is how Kenneth Ford describes it-- "It is everywhere and therefore we should be mindful of it."

Bajwa Roodra Pratap Singh
MS Scholar,
Mechanical Engg.

"Audentes Fortuna Juvat"



A 450 crore ride to our neighbor: Indian Mars Mission

It always makes my lips to curve and I smile when I think of discovering fairy lands walking into the back of wardrobe. So every time a mission to Mars is announced, I wait eagerly listening to news about spacecraft finding traces of methane, water channels, ice caps and what-not on Martian lands. With same curiosity of young child in me, I found myself turning over pages about Indian Mars Mission-“Mangalyaan”. I will try using conversation between two moons of Mars discussing about the Mars mission (but the authenticity of the information is entirely mine!)

Phobos is older of the two people who are going to be with us. He is a bit less-adventurous, sullen and takes a gloomier view of life. Deimos is younger one with a daring spirit and is happy, cheerful and seeks out to find new places. The pair come to know about the mission through the rays of Sun bringing them the news that a new ‘member’ is about to visit the abode of Mars.

Phobos: Hey Deimos! Did you hear about the new spacecraft leaving the Earth to Mars on **November 5, 2013?** It will reach us by **24 September, 2014.**

Deimos: Oh yeah. I came to know about it a few days back. It is nice to have a friend from abroad. Which launch vehicle did they use: GSLV or PSLV?

Phobos: What sort of question is this? For 450 crore mission, will they use GSLV which has the lowest success rate or PSLV which launches everything into space?! Of course PSLV! To be precise, it is **PSLV-XL launch vehicle**, designated C25. They could have done better to get their GSLV corrected than send spacecraft for “sight-seeing”.

Deimos: Don't be such a spoil sport. It is all about curiosity to know. I also dearly wish to know what makes people fall in love. How are they getting here anyway? We all know the red-guy is not

too friendly to visitors; they have long inter-planetary distance to coast and not to mention escape from Earth's gravity.

Phobos: The spacecraft will travel in elliptic orbit around the Earth from November 5 to December 1, 2013. With each rotation, the **apogee**, the farthest point from Earth's surface, will be **raised by six orbital maneuvers**. Once an apogee of 192000 km is reached, the spacecraft would have gained a hyperbolic trajectory and will travel to Mars for a period close to 9 months. The Sphere of Influence of the Earth ends at 918347 km from the surface of the earth beyond which the perturbing force on the orbiter is mainly due to the Sun. Did you know something went wrong with the fourth orbital maneuver?

Deimos: Can you be bit sober when you say that? Why are you so excited when something goes wrong? But tell me what happened?

Phobos: I am not happy seeing my guest having the wing clipped momentarily but merely was saying ISRO hurried to finish this mission in 15 months. Why such hurry when the red guy is not going to leave anytime soon? Well as to the **4th maneuver** on November 11th 2013, the **liquid fuel thruster** had some problem and spacecraft attained **additional 35 m/s** and **reached apogee of 78,276 km** as **opposed to 100000 km** as target. But no harm done. They have **supplementary thrusters** and **attained 118,642 km** apogee on November 12,2013.

Deimos: Don't be so much ignorant. They have to launch within this launch window. Such an arrangement of minimum energy opportunities for Earth-Mars recurs periodically at intervals of about 780 days. It occurs in November 2013, January 2016, May 2018 etc. So instead of waiting for next window in 2016, they just did a good team work

Phobos: I was merely saying space is ruthless and any mistake will have unforeseen consequence here If you have hole in the pocket and only a coin to feed yourself, you will not put the coin in pocket with hole, right?

Deimos (yawning): Yeah, yeah. Keep your rotten philosophy yourself. I heard it is a “**technology demonstrator**”

mission for inter-planetary journeys. What are they carrying aboard this time for scientific exploration?

Phobos: Well the spacecraft has a **dry mass of 1337 kg** and has a **payload of 15 kg** of scientific instruments. They are carrying 3 categories of scientific instruments aboard for **Atmospheric studies, Particle environment studies and Surface image studies.**

Deimos:

I guess they are going to check for the usual Methane levels in the atmosphere in atmospheric studies.

Phobos (snorting): Yeah! With Mars Science Laboratory (MSL) and Mars Exploration Rover (MER) rovers teeming on the surface and not able to detect much, this mission is trying to find needle in haystack and that to from orbit of 366×80000 km circling around the Mars. Also they have a Lyman Alpha photometer to measure the relative abundance of deuterium and hydrogen from Lyman-alpha emission in the Martian upper atmosphere.

Deimos (irritated):

All you do is keep going round and round around Mars. This is the start for Indian mission. They will come around sending new missions to Mars. Did you know NASA is spending \$17.7 billion but ISRO uses just \$1.0 billion annually? So don't give your opinion and get on with the facts.

Phobos: I just hope following your line of argument, India will send another orbiter to circle around me. I can then let it gather all information and pass it on to me in neat encyclopedia galatica.

Deimos:

Wish-full thinking. I just hope the red-guy chucks you out to Venus from where you came from. Explain about payloads or get lost.

Phobos: I was here first, you evil twin. As to other payloads, they have your favorite methane detector (Methane Sensor for Mars) for atmospheric studies. For **particle environment studies, Mars Exospheric Neutral Composition Analyzer (MENCA)**. MENCA is a **quadrupole mass spectrometer** to study of the neutral composition of Martian upper atmosphere. They have a couple of **surface image studies equipment- Thermal Infrared Imaging Spec-**

trometer (TIS) to map surface composition and mineralogy and **Mars Colour Camera (MCC)** to give colourful images of Mars and appease the tax-payers-just kidding! MCC is used for spying on us, take images of Mars surface, its payload and send to Earth.

Deimos:

That's a decent first mission I guess. How do you feel about the mission now that it has been successfully launched?

Phobos: If I were an astronaut on spacecraft, I will not call the mission a success till it reaches Mars. Maybe wait till **December 1st when it will enter the hyperbolic trajectory to Mars.** Then I will breathe freely.

Deimos:

Ok! But I have errands to attend and I want to know how you feel about the mission. Quick!

Phobos: Well... as to the failure of Chandrayaan-1, I heard the people say it completed 90-odd% of the mission in 10-months. Then what was the purpose of keeping the mission profile planned for 2-years? It doesn't make me feel at ease. I am also eternally cursed to stay close and not know if I will ever know why I am here. If the human endeavors help me find some answers, I will be happy. I will be happier, if there are scientists who brave the failure as much as success.

Deimos:

No one knows what to expect in new places. So maybe Chandrayaan did complete its stipulated mission target in 10-months. I am excited to see the orbiter reaching us next year. It has been rather lonely and cold these days. Okay have new information feed. See you.

(The views presented here are my own. All information is either obtained from official website- <http://www.isro.org/mars/home.aspx> or from trusted dailies.)

Vasanth Kumar Gurushankar
MS Scholar
Applied Mechanics



"I like to go along R.K.Laxman's 'common man' and see how the world works"

correspondents'

corner

Tech-O-Philia: Smart Watch

In 1972 famous comic character took the world with surprise with his two-way wrist radio – a radio cum wristwatch. Who would have guessed that the adventures of Tracy would be a game for common man? Well the good news is that the secret of Tracy's watch has been unleashed and 2013 brings along with other surprises something, now commonly known as smart watch. If we follow the writing on the wall then even famous consumer device analyst Avi Greengart from research firm Current Analysis suggested that this might be the "year of the smart watch".

Several companies such as Acer, Apple, Google, Microsoft, Samsung, Sony and Toshiba have joined this race as no one wants to lose the vast consumer base promised by this attractive technology. But it is said that one should always acknowledge the roots. The genealogy of the smart-watch could be traced back to 1983 when Seiko started working with

skeleton of first smart-watch. The first watch – "Data 2000 watch" allowed data entry via an external keyboard (imagine the real pain). This watch was capable of storing up to two thousand characters at a time. Later in 1984 the D409 watch was introduced, which had an on-board data entry. Soon Casio entered this race and released a successful range of computer watches. In 1985 Seiko RC series produced the world's smallest terminal with 2KB storage (RC-4000 PC).



What is Life – Erwin Schrödinger

(My Rating: 4.5/5)

(Book based on lectures delivered by author at Trinity College, Dublin in February 1943)

In this book, the eminent physicist Erwin Schrödinger considers the working of a living cell or living system from a physicist's point of view. This book was published in 1944, when little was known about the working of cells. But he establishes his stand as a staunch rationalist. He states that just because the present day knowledge of physics and chemistry is unable to explain the detailed working of a living system, it does not imply that life cannot be explained by these sciences in future. Even thinking is an orderly thing and takes place through a physical organization, he argues. Thus, all life processes must obey some laws of physics.

Classical Mendelian genetics is explained in a lucid tone. The statistics behind the harmful

effects of close-breeding and the role of mutations in evolution are explained beautifully.

Occasionally, analogies are made with physics laws. The discontinuous phenotypes explained by De Vries' mutation theory might remind a physicist of quantum theory of energy, he ponders. After all, the idea that discontinuity or discreteness exists in nature was first put forward by quantum theory.

He offers a lot of discussion on the structure of chromosomes. He suggests that given its stability, the DNA must be a molecule. Also, the discontinuous melting curve suggests that it is a solid crystal rather than being amorphous. He further says that the genetic material must be an 'aperiodic' crystal to act as an information carrier. These predictions turned out to be true after the structure of DNA was proposed by Watson and Crick in 1953. The Nobel laureates; Watson, Crick and Wilkins; all later acknowledged that their interest in the structure of DNA was sparked by this book by Schrödinger.



But how could International Business Machines (IBM) stay out of business and the year 2000 saw the first watch that ran Linux. The original version had a battery lasting for only six hours. It ran on Linux 2.2 and had 8MB of memory (sorry no YouTube video could be stored). The device was upgraded with an accelerometer, vibrating mechanism and fingerprint sensor.

As of 2013 the race is still on with the Samsung Galaxy Gear, Sony SmartWatch 2, and the

Qualcomm Toq already flooding the market. Still in the conceptual phase but not out of race are the much awaited Pebble's Smartwatch, Martian Smartwatch, i'm Watch and ConnecteDevice Cookoo Smartwatch. These smart-watches have Bluetooth connectivity, which allows a connection with a compatible smartphone. The wearer would be able to check messages, receive calls and control music player. For the social networking freaks a continuous connectivity with Facebook and Twitter is also present. A large number of companies are using Android as the operating system facilitating app downloads. Presently apps are available for a variety of tasks like track fitness, set alarms, create notes and so on. So guys keep your clock ticking and watch out for the new "smart" watches in town.

Suyash Gupta

MS Scholar
Computer Sc. & Engg



"They said its good to dream, so I only dream"



It is a fundamental law of physics that things tend to approach the state of maximum entropy (or chaos). So, it is really remarkable how living organisms maintain themselves at a state of extreme order. Schrödinger postulates that the marvellous faculty of a living organism to maintain a state of low entropy before it approaches the state of maximum entropy (i.e. death) depends on its ability to extract order from the environment. For instance, higher animals feed upon the extremely well-ordered organic compounds, which serve them as foodstuffs. After utilizing it they return it in a very much degraded form. Schrödinger calls this the 'order-from-order' mechanism of maintaining orderly systems. In

conclusion he says that new laws of physics must be expected to be operating in living organisms. This doesn't mean that some 'new force' will be found to be involved but only that the construction and manner of working will be novel.

The book is an interesting read for all biologists and physicists. But I suggest that every scientist should read this book to appreciate the process of scientific thinking and rational approach.

Prajakta Naval

PhD Scholar
Bio-technology



"A lazy day, a cozy corner and a good book: a perfect stress buster"

C O I U M N S Experiences from Exchange

My Little India

La Chapelle, Paris. If you come to visit Paris (contact me!), there is actually few chance that you end up in this area, unless you get lost on your way to the Eiffel tower, Montmartre or Louvre. But since I came back from India, it has started to be one of my usual hang-out place, simply because it's the only area in the city where I can find a nice Indian tea shop, Bollywood movies, people walking around in kurtas and saris, and the best dosas and chicken butter masala of the city.

It is called Little India, and whenever I feel I need to revive my Indian memories, I just go there, bringing my friends who could not come to visit me while I was in Chennai and dreaming about next journeys to India.

It has been six months since I left, and I have been asked quite a lot of times about my stay there. After one year (or more precisely, ten and half months) in India, I actually have spent a bit of my life there in India, at IITM. Given my introduction, you will have already understood that I have experienced a great time there and that I enjoyed every second of novelty to which I was confronted.

Let's start with academics. I had decided to attend courses in two departments. Mathematics was not my cup of tea because I personally think that to be a good mathematician (I admire them!), you should be leading some kind of a cloistered life. Mathematics is its own (and yet fascinating) world but you can understand that I had not come to India to bury myself into convex analysis. So, I was much more excited by what you call in English-speaking countries "Humanities". As an economics student, I would nearly take an offense to be referenced like this in France, where we consider scientific subject any rigorous and argued studies. But here, this was just a way to differentiate us from the ma-

jority of engineering students. I was really impressed by all the problematics of developmental studies, first because I never studied social sciences (sorry, humanities) with this approach, and secondly they made me realize how what we call "developed" and "developing" societies is such an economically narrow-minded point of view.

College life was great because for the first time, I enjoyed a campus life at IITM. Studying in the lap of nature surrounded by monkeys (yes, I still have some empathy for them), going around with my cycle, attending Saarang, all this made me feel that IITians experience a very nice environment. Especially because studying and living at the same place (basically the definition of a campus, which lacks in my university) gives you much more time to make real friends. I developed strong connections with a lot of people, and I hope the Ipals still succeed in integrating foreign students to the college community!

If I loved the campus, travelling around was always an amazing adventure: sightseeing, visiting temples, nature and more than that, human experiences. Some of my best memories are not in the places I visited, but just in travelling, especially in train journeys. There, I really had the feeling to discover, to interact and to learn a lot about others. I enjoyed my first long train journey with an Indian family who had decided to feed me all the time, but who would not let me buy them a chai. Very often, I was really surprised by generosity and by the curiosity of my seat neighbours. I must say, it does not happen so often that I start chatting with unknowns in the Parisian metro!



Mathieu Ferry
Exchange Student
Humanities

है
बप
रहनेवने

पाखी

तन्हा खोए से अहसास में,
कहने-सुनने की आस में,
दो बोल लिखे तेरी शान में,
इरशाद का इंतजार रहेगा...

हाथ थामने की आस में,
तेरे होने के अहसास में,
दो आँसू बहे तेरी याद में,
पनाह का इंतज़ार रहेगा...

इक दस्तक के इंतज़ार में,
उस दरवाजे के पास में,
दो रातें जागी तेरी आस में,
आने का इंतज़ार रहेगा...

कुछ बेबाक मुलाकातों में,
बेचैन सी उन बातों में,
दो लफ़्ज़ तेरी बेरुखी में,
सुलह का इंतज़ार रहेगा...

तेरी हर ज़िद को अपनाने में,
थक चुकी तुझे मनाने में,
दो चिट्ठियाँ लिख छोड़ी सिरहाने में,
जवाब का इंतज़ार रहेगा...

Aditi Yadav
MS Scholar
DoMS



*"Researching myself...
phrasing my feelings"*

Varun Jain
MS Scholar
DoMS



"Dragons Eye ;> !!!"

ShutterBug

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BIOMERS



Research scholars of Biotechnology department organized BIOMERS - Biotech Meet for Researchers and students in Biosciences, Bio-engineering, and allied areas to showcase their research as oral presentations and posters.

Addressing the gathering at the Biotech Seminar Hall, Dr. Bhaskar Ramamurthy explained that student organized events such as BioMERS and those happening in other departments bring scholars to think consciously about the role they play in their department,



Photo Credits: Anirudh

RoS 2013



in the institute, and the nation. He also expressed hope that more interdisciplinary events would be organized by scholars.

The two day conference was not limited to just students. Eminent scientists invited from all over the country shared their research with students. Between the oral presentation sessions, crowds of students thronged the 30-odd poster boards and nearby corridors and open spaces to have conversations on nanotechnology, genes, cancer, metabolomics, simulations, vaccines, fuel cells, nerves and biomolecules.



Malini Sundar Rajan
PhD Scholar,
Biotechnology

"In Observer mode"



Out of My Mind

'Out of my mind' is a column that always starts with a *Bonjoe* pj!

Bon: Hey Joe, If you are me and I am you, who am I?

Joe: *(thinking)* I guess you.

Bon: *(laughing)* NO dude its me!! Hahhahaa because you are me!!

It is always auspicious to start with an insane and sarcastically funny joke. This is a new column 'Out of my mind'(OM2) which will talk about some interesting 'brain fundas.' We wish to disseminate Science via a fun-filled, fictitious story-telling mode. Every month we will impinge upon some interesting brain talks in a crafted episode-like story. We have tried hard to reduce the technicality as possible, however some terminologies are preserved as they form an important part of the 'funda' we wish to highlight in our column. The quantitative knowledge one gains from the article is totally dependent on the reader.

Hey Guys! Hope you had fun reading our first segment of OM2 and enjoyed it. Current segment of OM2 will talk enshrine upon another intriguing brain funda in the plot of "Back to the Future" Trilogy with the Marty McFly and Dr. Emmett Brown, "Doc" as the protagonists.

PS: "The context of the series is whatsoever adapted as per our norms to describe our views keeping the basic characteristics of the protagonists conserved. Science is all about fun so be light headed and enjoy!"



Back to the future: The unheralded brain

Year 2014

"Tring TRING TRINGGGGGGG..." Alarm yelling. With his one hand trying to reach out the clock, Marty McFly rubbed his eyes with the other. He glanced at the silver beeping clock and jumped out of his bed realizing how late he was. Suddenly, the LED screen on his mobile lit up, vaguely visible from his blue translucent bed cover..."DOC Calling....."

Marty: Hey Doc..

Doc Brown:*(with his hasty voice)*

Marty!! Where are you? Its 5:25 am!!! want you to be here in 5 minutes!

Marty: *(still rubbing his sleepy eyes)* I know Doc.. What's the rush? I will be there in 20 minutes..

Doc Brown:*(snapped)*

That would cost me a year of the future! You can't be late!! Be here in 10 minutes.

The line went dead...

Marty threw up the sheets, grabbed his bag and rushed downstairs towards the garage where his scooter was parked.

It was 5:34 am and Marty was standing next to Doc Brown, who was now shuffling the cables coming out his MAC device. One of the cable was going to his car (THE TIME MACHINE!!) and another to the flux capacitor. He removed these two cables from his MAC after setting parameters for automation (Biofuel usage/sec, speed/nanosecond, temperature, oxygen pressure etc).

Doc Brown: Just a few clicks and Marty, we will be travelling in the space-time conundrum!

Marty with his gleaming eyes wondered how the Doc's excitement never slobbers in spite of the routine voyage through space-time.

The next moment Marty and Doc brown were in the car, while the touch screen next to the steering wheel started prompting the countdown for the take off.

Marty thought to himself unlike the older times, now the time does not seem to move past in a fling.

Marty:(..as the take off started) Hey Doc.. Once again why does the time elapsing seems to be slower to us when apparently it's not?

Doc Brown: (His eyes scanning over the car's roof) The newer version of the machine works on Psuedo Time dilation principle wherein your brain is so tuned by the small bronze colored devices you can see on the roof. It is precisely fooling your brain by playing with the brain clocks. You see the green control on the console touch screen. It tunes the intensity of time delay and...

The whole device shuddered followed by a voice:

(In Spanish accent) 'Year Two O Five Five.' Please enter your destination.

Marty: That's Spanish eh?! Doc. You are the Doc!

Doc Brown browsed his finger around the console screen and typed: LM12564OP

Marty: What is that?

Doc Brown: (smiling deviously) That's the code to my lab.

Marty:(bewildered!) Wha..?! What? You will be alive in 2055?!!

(Now wiping the sweat from his forehead and recollecting his senses.)

Marty: Sorry but how is it even possible?

Doc Brown: (laughs) Yes that is! My dear Marty welcome to year 2055! (holding his iPad, flipping through the open parchment) See, aging lies in the brain and not the body. In 2055, we have a device called: Glimagnifect. This device has a skull cap which you need to wear for 15 days that boosts up your life for 10 years by increasing the longevity and number of a typical kind of cells in brain called Glial cells! That is

why the Doc will live forever! Hahhahaa

Marty:(bewildered) Seriously?? An... And you wanna say there are no aftereffects?

Doc Brown: No My dear Marty! No aftereffects at all, however there is a constraint that you cannot use it more than 5 times. That's more than enough I guess.

Marty: But Doc.. Just increasing the number of certain cells in the brain would defy aging!! Why only these cells then? What about neurons?

Doc Brown: (with a witty smile) Marty my boy your questions are obvious and I was expecting them. Well, there is something very different about these cells that make them an elusive target for countering aging. These glial cells are not just any other cells. These are packed with age defying antioxidants like glutathione! So my neurons would die faster without the glia. Infact, another facet via which these cells increase the longevity of the neurons is by providing growth factors, technically called as neurotrophic factors. So precisely the boosters act by increasing the neuro-protective power...

The car halted, seat-belts unfastened and the doors opened the very next moment.

Doc Brown: Anyway lets carry on. There is so more excitement to come and we don't have much time!!

(Spanish Accent): **Welcome to LM12564OP, Doctor Emmett Brown's Lab. You have 15 minutes before the take off. For next biofuel recharge, press 'R' and leave the door closed MARTY!!**

*Marty: (rushing out, then stopped on hearing the voice)*WWhoaa... She knows me?!

Doc Brown: Of course, She does! PATTERN RECOGNITION Marty!!

While in the lab, Marty stood stunned still trying to believe what he was observing. Meanwhile Doc Brown was hastily searching for something which Marty could figure out by his quick finger movements in the air. With his finger movements, there occurred streaks of

C lightning sparks in the air which looked like pointing to different locations in the lab.

Doc Brown: Ahhh! There it is!

He rushed towards a passage which looked like a sunken hallway. In the next moment, he returned with a wooden oak box almost the size of iPad. He opened it and yes it was an iPad.

Marty: (*frowning*) You wanted to show me an iPad from 2055??

Doc Brown: (snapped) No!! Ofcourse not! That's not an iPad. That's my next invention!

Doc Brown: (Eyes wide open) This Marty is the Brain-o-corder. This device can sneak through your brain, while reading your mind. It can tell you what exactly is the status of your mind, what would you do the next moment and other futuristic predictions like diseases you would develop, your next booster time and your death time.

Marty was speechless...Doc continued..

Doc Brown: The biggest chunk of truth is that it tells you all of this based on the phys-ibichemical properties of the cells I mentioned; The Glial Cells..

Marty:(*interrupted*) Tell me more about these cells.

Doc Brown: The name "Glial" in Latin that means "glue". It was named so due to the orthodox view long back about these being the connective tissue in the brain, similar to blood and bone in our body. But it is not just that! Infact now all brain scanning devices, therapies are based on targeting these cells. These non-neuronal cells cover 95% of your brain!! These control almost every aspect of your brain!!Phew!

Doc Brown: (*Glancing down at the device*) I met Professor R. Douglas Fields in 2013. He is a glial biologist and sent me an alluring mail saying he has the secret of controlling the brain!!

Doc Brown:(*squeamishly*) Marty my boy! An age is about to come which would show that all the diseases are resultant of the funda-

mental faults in the brain and not in the body. An age of mind medicine!

Doc Brown: (now positioning the device in front of Marty's forehead) Lets see what is there?

Marty: Doc...

Marty felt an oblivious void for a fraction of moment and then the screen on the device beeped..Scan finished! Marty moved to Doc Brown's side and eagerly looked at the screen of the device that read:

91.5689099% glial content..

Please blink thrice to continue..

Doc Brown blinked thrice hurriedly..

Thank you. Processing...

Marty held his breath..

Your age cannot be detected due to the space time conundrum...

Present status:

Neurodegeneration slow at 0.2564 cells per nanoseconds. With this you need the first age booster in the next 3 years at level 2.

With five boosters of level 2, you can live for 57 more years.

Your love status: Healthy with 89% love for Jennifer.

Your thought while scanning: Doc Brown is nuts..

Doc Brown raised his eyebrow and looked with a narrow eye at Marty, who was gushing with embarrassment. Next, the screen displayed:

Your microglia immunity is 69% and you have chances of HIV infection whose percent profile would increase in absence of booster.

Marty: Microglia?

Doc Brown: Microglia is a type of glial cell in brain similar to the white blood cells in blood. They are the main players in maintaining the immune system of the brain and also the culprits of all neurological diseases. The later effect would come into play when microglia

goes bad. Infact, microglia is the mobile element in the brain. They can move throughout the brain and protect the brain and once they go bad, they act as the agent for spreading diseases inside the brain, be it cancer or infection or neurodegeneration.

(Suddenly, the wrist watch on the Doc Brown's hand started to beep. The car calling...)

Doc brown snapped the device, tapped gently on the screen (which went black) and placed it carefully in the oak box. Then he rushed towards the same hallway...

Doc Brown: 69 seconds!! The conundrum will take over. Marty we need to rush!!

In the next 35 seconds they were out of the lab. In front of them, the car opened and was already beeping and flickering giving a speedy signal. They sat in the car and doors closed..

(spanish accent) 3 2 1.. We take off...

While in the car, Marty's mind went through the events he had recently encountered, specifically about glial cells. One could never think of some non-neuronal cells controlling and being responsible for the basic phenomenon in the brain and Whoaaa controlling age through action on brain!! Certainly not! He thought to himself..

Marty: Hey Doc! What else do these glial cells do?

Doc Brown: A million dollar question!! Prof. Fields call the glia as the other brain controlling the neuronal brain. So the functions are extremely varied and mostly elusive.

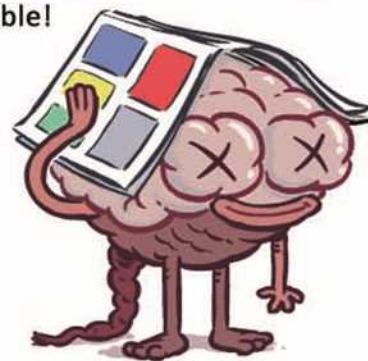
Alongside elongating the life span of the healthy neurons, they scavenge and destroy the infected diseased/dead neurons. We believe that the brain is hard wired but no! The wiring is continuously modified by these glial cells after every new experience of our lives.

The artists, painters, musicians and the big imaginers were thought to have totally different

configuration of the brain, but anyone can become any of these because it's the way how glia prune the formation and breaking of the neuronal synapses. The intelligence of an organism is a function of the organizational pattern formed by one of the categories of these cells called radial glia. Their domains in the brain are highly structured and organized, insight of which is not known at the moment. But as you saw, we will definitely bear the privilege of knowing about it in future!

After a brief pause, Doc Brown spoke again while swirling his fingers through his fragile white hair..

I came to know about Prof. Fields when I read about Einstein's Brain project, which depicted: it's not the number of neurons neither the number of connections in the brain, instead it is the number of glial cells that differed in his brain and made him exceptional. But I believe that's just for the sake of motivation!! I want to believe that there is something really fundamental about these cells that matters rather than the number. So my dear boy we are almost there to solve the biggest mystery of consciousness but a whole different and broader mindset is required to see forth the answer to this big puzzle! And as evidence from the future it is definitely possible!



Mandali Alekhya
PhD Scholar
Biotechnology

"I luv to eat n sleep!"



Karishma Chhabria
MS Scholar
Biotechnology

"Exploring the pun of life!"

researchers' inc.

Pulsing Lasers Using Q-switching

Fiber Laser Lab

Department of Electrical Engineering
Supervisor: Dr. Deepa Venkitesh

Research inventions have a funny way of manifesting themselves. Some developments have so far reaching applications that their inventors could not have thought of them in any possible scenario. A prime example of such an invention is the laser. The term laser is an acronym that stands for Light Amplification by the Stimulated Emission of Radiation. It was conceptualized by Albert Einstein himself in his 1917 paper "On the Quantum theory of Radiation" and demonstrated by Theodore Maiman in 1960. Technically the phenomenon of producing laser light involves oscillation instead of amplification. However the acronym "LOSER" is not one which the inventors would have been very happy with!

The laser operation can be briefly described as the following: A cavity resonator which has feedback (and thus is capable of oscillation) has a gain medium in it. Energy is pumped into the cavity and oscillations begin. The gain medium amplifies the light (by the process of stimulated emission) a small part of which is tapped out of the setup (while the rest is fed back into the cavity). Such setups typically produce continuous wave (CW) light and are useful for a lot of applications. However, for applications involving high power requirements, it is more efficient to go for pulsed laser sources instead of the CW mode of operation. The laser output can be "on" only for a short duration of time (in which high power is delivered) instead of the entire time duration of operation.

One of the primary methods of operation is known as Q-switching (QS). Manas Srivastava, a PhD student in the Fiber Laser lab of the Electrical Engineering Dept. of IIT Madras, and his co-workers have been studying QS using computational and experimental means to study this phenomenon. The "Q" in QS stands

for the "Q-factor" of a cavity and is a measure of the energy lost relative to the energy stored in the cavity. A higher "Q-factor" indicates lower energy loss in the cavity. QS involves building up the energy in the cavity while keeping its "Q-factor" low. This prevents oscillations from setting in and the laser being produced. Then the "Q-factor" is abruptly increased so that all the energy is released in a short duration of time (as a pulse). This process is repeated to get a train of pulses. "Q-switching is thus the modulation of the Q-factor of an optical cavity for producing very short duration pulses of light" says Manas. These pulses typically have peak powers in watts and durations of nanoseconds. Some examples of such pulses and the setup to produce them is shown in Fig. 1. Pulses obtained using Q-switching find applications in metal cutting, pulsed holography, nonlinear optics and measurement purposes. They have also been used for tattoo removal.

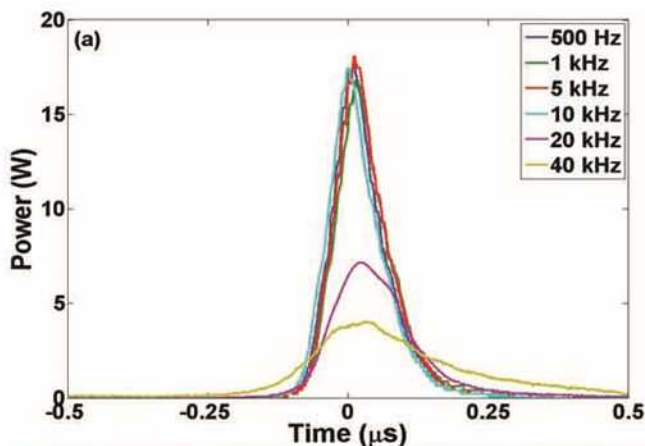


Figure 1: (Top) : Pulses obtained by Q-switching a laser. (Bottom) : A ring laser which performs Q-switching and produces laser pulses.

The work done by Manas and his coworkers have spawned various other studies in his lab such as laser spectroscopy, increasing the peak

powers using power amplifiers, optical communications. Let us hope that all these studies lead to technological developments which far reaching applications.

Guru Venkat
PhD Scholar
Electrical Engg.



"Any sufficiently advanced technology is indistinguishable from magic"

researchers, inc.

Of Caffeine & Social Amoebae!

Laboratory of Developmental Genetics
Department of Biotechnology
Supervisor: Dr. Baskar R

Social Amoeba (*Dictyostelium discoideum*) is capable of some very interesting things. But before we go there, a small introduction to what Developmental Biology is all about.

As the name suggests, it is the study of biological development of organisms. For instance, have you ever wondered how the human baby develops from a bunch of stem cells into the final human form? Any engineer/scientist would appreciate the enormous complexity of the task facing these stem cells. All they have to guide them is the enormous human genome code with the "master recipe", so to say. How does one single cell decide to turn into, say, a muscle cell, and another, right next to it, decides to turn into a neuron, and so on? Not only should the development be accurate spatially, but also precise in terms of the time at which a certain stage of development is to take place. These large number of cells have to communicate amongst themselves and with the mother's body (through the placenta) to ensure spatially and temporally precise and accurate development. If the jigsaw puzzle does not fit into the proper finished form, we would have a dysfunctional organism! The amazing process through which an organism develops and grows is the area of study in Developmental Biology.

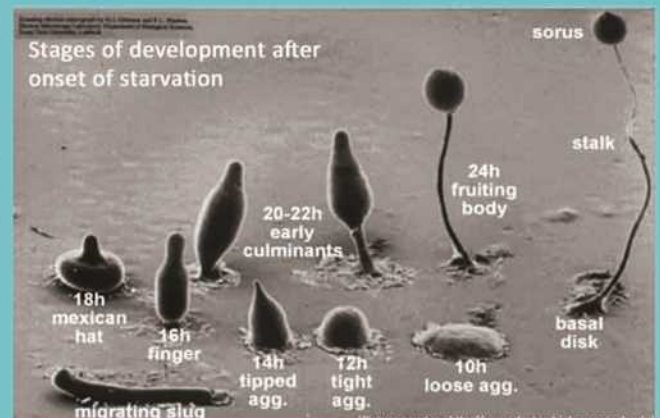
We are all familiar with the use of rats for vari-

ous medical/biological studies. They are known as "model organisms". Similarly, Social Amoeba is also a model organism. By studying them, we attempt to understand various aspects of development in more complex organisms.

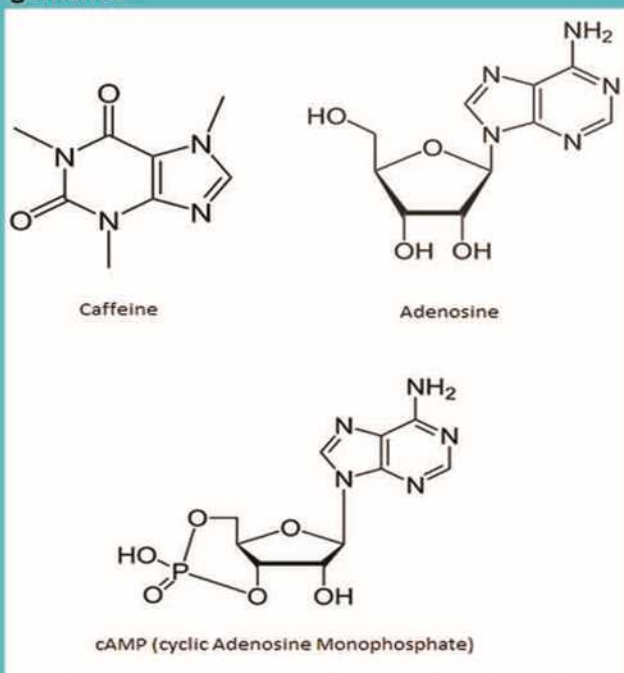
Social Amoeba

Social Amoebae are unicellular organisms, usually found in soil, feeding on bacteria present in these environments. At this stage of their life cycle, they are free ranging individuals which seek out bacteria and "eat" them through phagocytosis. When the population of bacteria falls, and the amoeba begin to starve, they show a very interesting transition from free ranging individuals to a tendency to aggregate. They communicate to each other by using the molecule cAMP (cyclic adenosine monophosphate) as a signal. cAMP is a very important "messenger" molecule that is present in many organisms (including us) and plays an important role in several biochemical processes.

The amoebae send out pulses/waves of cAMP when they begin starving. When there is sufficient amount of cAMP concentration, other amoeba sense its presence and move towards the source by following the direction of increasing concentration gradient. About 100,000 individuals club together to form a slug or worm like body. The slug has a definite anterior (front portion) and posterior (rear portion) and is capable of movement. Imagine 100,000 amoebae communicating with each other to generate their wave like motion, so that the entire body of the slug moves! These slug shaped bodies move towards light, heat or humidity.



If conditions of starvation persist, the slug's body too begins to undergo changes. The posterior begins to form into a bulb shape while the anterior takes the shape of a stalk. When the slug finds suitable environmental conditions, the anterior adheres to the surface while the posterior rises vertically to form a stalk and bulb like structure, called the fruiting body. The bulb contains a large number of spores which are eventually released and carried away into new environments. If the spores find themselves in favorable environments/conditions, they will germinate into amoebae once again and the life cycle is complete! Their simple life cycle is one of the reasons for their widespread use as model organisms.



Notice the structural similarities of caffeine, adenosine and cAMP

Caffeine, found in coffee and energy drinks, is the world's most widely consumed drug, known for its effect as a stimulant. Like glucose and alcohol, caffeine can cross the blood-brain barrier; and brings about its stimulant effects by its action on adenosine receptors in the brain. Caffeine is able to bind the receptor for adenosine; since it is structurally similar to adenosine (in technical terms, caffeine is an analog of adenosine). However, the effects that caffeine brings about on our body are opposite to that of adenosine (in

technical terms, caffeine's effects are antagonistic to those of adenosine).

If you notice the spots on Cheetah or in Leopards, they are spaced evenly and do not merge with each other. The guess is one spot inhibits the formation of another. This is pattern formation and Dr. Baskar's group is investigating similar problems but in slime molds.

The slug tip called the 'organizer' acts as cAMP signaling center but in the presence of caffeine this control over the rest of the slug gets erased and many signaling center arises along the slug axis. This is akin to the coat color pattern in animals. They found that caffeine interfered with the intercellular communication pathways and that the slug would have an altered form, i.e. multiple tips (anterior or heads). It also resulted in a smaller aggregate size. Such studies show how various different molecules can interfere with cellular communication pathways to bring about various effects visible on the entire organism.

For curious readers, the publications resulting from this research are:

Jaiswal P, Singh SP, Aiyar P, Akkali R and Baskar R (2012) Regulation of multiple tip formation by caffeine in cellular slime molds. *BMC Developmental Biology* 12:26

Jaiswal P, Soldati T, Thewes S and Baskar R (2012) Regulation of aggregate size and pattern by adenosine and caffeine in cellular slime molds. *BMC Developmental Biology* 12:5

Dr. Baskar's lab also studies spontaneous mutation rates of *Arabidopsis thaliana*, the only model organism that is a plant. His webpage is <http://www.biotech.iitm.ac.in/RBaskar>

Aditya Narayanan

MS Scholar
Ocean Engg.

Trace analysis using Raman scattering
Bio-sensors lab
Department of Applied Mechanics
Supervisor: Dr. Raghavendra Sai

A huge number of applications depend on identifying the constituents of a mixture. This extends from identifying the elements in a piece of evidence for a forensic investigation (remember the TV series *Bones*?) to identifying the "chemical composition, temperature, density, mass, distance, luminosity, and relative motion (whoa!!!) of distant stars and galaxies" [Wikipedia]. All these form a part of "Trace Molecule Analysis" (TMA) in which Christina, a PhD scholar in the Dept. of Applied Mechanics, is making new headway. Let us find out more.

Spectroscopy is a very powerful tool in TMA. A spectrum can "tell us what an object is made of, how hot it is, how fast it is moving, and a host of other important attributes". A very popular form of spectroscopy is Raman spectroscopy which is a consequence of the Raman effect. When photons (quantized light particles) collide with atoms/molecules (or other particles), they get scattered in different ways. In majority of the cases, the scattered photon has the same energy (and so frequency) as the incident photon (which is called Rayleigh scattering). However, very rarely (this happens for about 1 in 10⁷ incident photons), the photon gets scattered with a different frequency with which it came. In fact photons with either a lower frequency (called the Stokes component) or with a higher frequency (called the anti-Stokes component) get generated. Since this scattering is rare, it is quite difficult to detect these photons (and yet Raman and Krishnan did it using sunlight and photographic filters!). The light scattered due to this effect can be seen in figure 1.

The difference in energy (frequency) of the incident and scattered photons correspond to the vibrational energy of the molecule with which the photon collided. Thus the "Raman shift" can help identify the energy of the molecule causing the scattering and thus the molecule itself. This is the principle of Raman spectroscopy. A typical

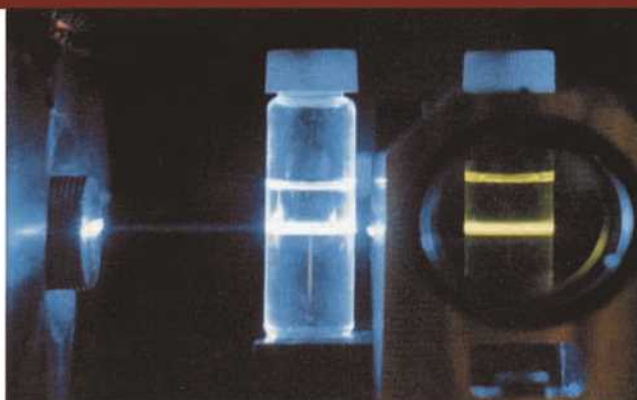


Figure 1: Raman scattering visible to the unaided eye from a laser beam passing through liquid cyclohexane. Left vial exhibits mostly Rayleigh scattering which obscures much weaker Raman scattering.

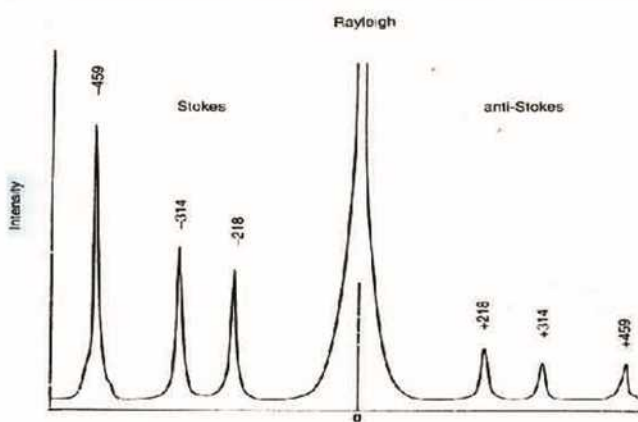


Figure 2: A Raman spectrum is a plot of the intensity of Raman scattered radiation as a function of its frequency difference from the incident radiation.

Since the Raman scattered signal is so small, a number of modifications have been proposed for amplifying the scattered signal. A popular one is called "Surface enhanced Raman scattering" (SERS). In this Raman scattering is enhanced by adsorbing molecules on a rough metal's surface which leads to electromagnetic boosting of the scattering. SERS was first observed by Martin Fleischmann (of "cold fusion" infamy). However, since this process involves dealing with the roughness of surfaces, repeatability is a prominent issue. Christina and her co-workers are trying to overcome these hurdles and advance this technique in which "single molecule detection" (imagine that!!!) is theoretically possible.

Guru Venkat
PhD Scholar
Electrical Engg.



"Any sufficiently advanced technology is indistinguishable from magic"

readers' articles

Writing an article: Know-how

You may think that I have tried to be different with the selection of the topic but you would realize the reason as you read on. On paper you would surely never realize what a person goes through while writing an article. Though I am going to make it appear theoretical by mentioning the stages in writing an article, I believe it would help to substantiate what I went through while writing for ReNews.

With articles in ReNews being predominantly authored by research scholars, the first stage one comes across is to "find time to write an article". The first stage could even be rephrased as "thinking of writing an article". Now, I am afraid that I would be laughed at for the last sentence since there is a wrong perception among many, with which I totally disagree, that scholars are laggards. Second, the topic on which one decides to write is another barrier to be crossed. We have unwillingly become 'technical' people: you would neither love to write a technical article nor would you have sufficient knowledge on the topic you would like to write on. So personally I would feel that selecting a topic is a difficult part of the process which explains my topic selection. From the precursor, the third stage would be explained. Upon starting with an article on a selected topic you would least probably withdraw from it, and with insufficient knowledge, you would even end up browsing for the contents and referencing it. Finding this practice to be wrong, I started reading a lot on various topics of my interest for the sole purpose of making my article realistic. Next comes the writing part which you have to carefully pass through since it may damage your message with the grammatical mistakes you commit. Displaying the content in a presentable and structured format is another task you need to do.

Finally, I must mention the jolt I received during my first publication - the one line blurb

the editors ask for. To be frank, I had never written about myself or even thought of myself in a single line. This is another daunting task in "writing an article". So finally you would find your photo and a one line blurb along with your beautiful article published.

P.S: These stages and views about writing an article are my personal experience. People with good writing skills who are familiar with various issues may not agree.

Rahul PR
MS Scholar
Chemical Engg.



"Loves being on his own and has interest in political science."

Connateness...

In a blessed state of mind, I write these lines...
Where I like to just "Be",
And be in this blissful state forever. . .
Where nothing else matters.

I "hear" silence where noise prevails,
I sit back, relax and gaze at the trees through
the window,
Dancing with the waves of the cool evening
breeze. . .

Inner silence deepened with time,
The mind turned void
And only the heart beat out of love for 'Thee' . .

I felt my own gracious presence,
And realized...
'Thou' and 'me' are but One. . .
'Thou' art the cause of my ecstasy...

Suresh
Senior Project Officer
Electrical Engg.



"Perseverance and Dedicated work in right direction are the mandatory tools for turning a "Dream" into a "Reality"."

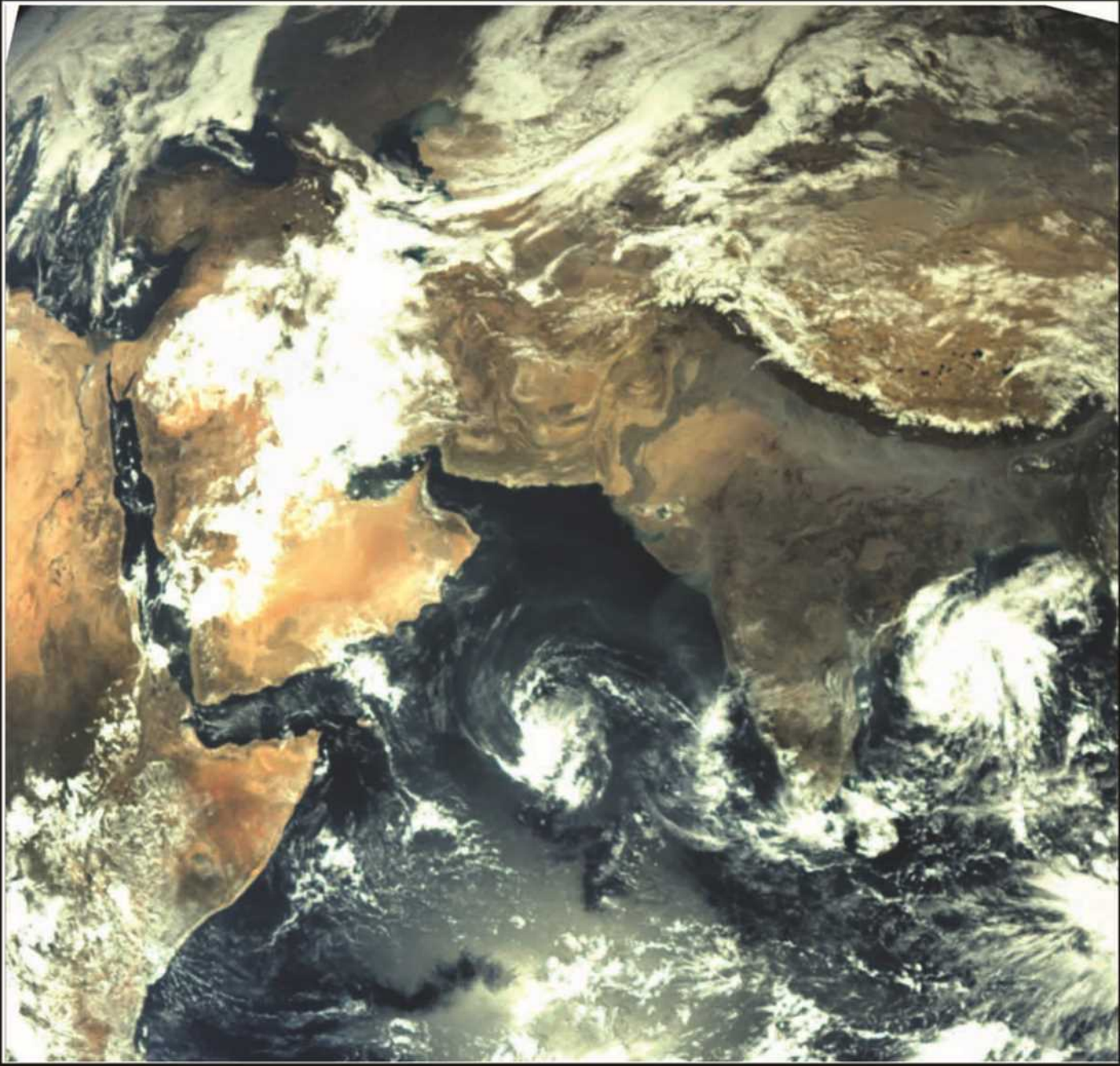



Photo of earth taken by Mars Color Camera (MCC) aboard Mars Orbiter - Mangalyaan
Source: <http://www.isro.org/pslv-c25/Imagegallery/satellitesimages/mom.png>



Photo taken from Pulicat Lake during the launch of PSLV-C25 on November 5, 2013.



Photo Credits: Chaitanya Vijay

A photograph of a rocket launch against a clear blue sky. The rocket is positioned diagonally from the bottom right towards the top left, leaving a thick, white, textured trail of smoke and vapor behind it. The rocket's nose is at the top left, and its tail is at the bottom right. The sky is a uniform light blue, with a few wispy white clouds visible in the bottom right corner.

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