

JULY 2017

the elixir



Editorial Board

Prof. Binny J. Cherayil
Editor-in-chief

Brij Kishore	Somarupa Sahoo
Lakshay Kathuria	K. Srividya
Nandini Mukherjee	H. C. Sudeeksha
Ria Sanyal	A. Vaishali

Design Team

Aman Jindal	Ria Mukherjee
Dipak Kumbhar	Tarun Gera

Acknowledgements

Financial support for The Elixir has been provided by the
Department of Inorganic & Physical Chemistry, I.I.Sc.



04	Indian Science: Not Irreverent Enough?
06	An Interview with V. Chandrasekhar
08	Almost There ...
10	Ola! Goa
12	IPC Day 2017
13	A Celebration of the Scientific Contributions of Prof. Munichandraiah and Prof. Jemmis
14	IPC Then and Now
16	Review : The Immortal Life of Henrietta Lacks

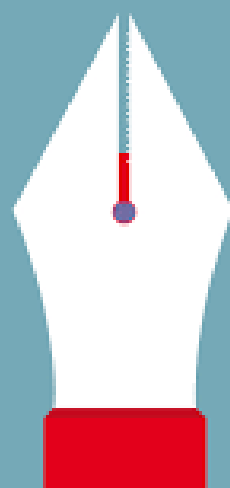
CONTENTS



18	Scientific Writing : A Workshop on Language Skills
20	Our Newly Minted Doctorates – Well Done!
22	A Chat with an Alumna of IPC
24	Book Review : Fever
25	IPC in the News
26	Borders in Science and Between Nations
28	Special Seminars
30	Goodbye and Welcome
31	Life @ IPC

INDIAN SCIENCE: NOT IRREVERENT ENOUGH?

Binny J. Cherayil



Graduation Day speeches are supposed to be uplifting, but someone forgot to tell Narayan Murthy that. Mr. Murthy, ex-CEO of Infosys, was the chief guest at the convocation ceremonies of the Indian Institute of Science in 2015, and on that occasion, perhaps stung by the recollection of the snide remarks that a former director of the I.I.Sc. is rumoured to have made about Bangalore's tech populace, he delivered a speech of gratuitous tactlessness. Among his many not-so-cheery messages to the Class of 2015 was this one: that their alma mater had done essentially nothing of note in the 100 years of its existence.

That may or may not be the case, but I think Mr. Murthy was mostly right in suggesting that the I.I.Sc.'s record of scientific achievement has been underwhelming. He shouldn't have been, though. There's probably as much grey matter here, per capita, as there is on campuses in Boston or Palo Alto. But for some reason, it hasn't produced anywhere near the same results.

So why is it that our science – and Indian science,

in general – is perversely unable to fulfill the promise of its hefty intellectual capital?

Better minds than mine have grappled with this question. R. A. Mashelkar, for instance, a former Director-General of the C.S.I.R., thinks it might be because Indian scientists aren't irreverent enough.¹ We're much too respectful, apparently, of both conventional wisdom and of certain figures of authority to come up with original and transformative ideas of our own. There's certainly something to be said for this point of view, even if it can't possibly explain everything that's dysfunctional about our science. The fact is, we do tend to hew rather too closely to the straight and narrow when we carry out research, and it may well be because we've long been programmed to treat certain people and certain ideas not just with reverence but something close to fawning obsequiousness. Which is probably why we'd be as likely to take umbrage at some perceived slight to, say, a J. N. Tata, or even a Tata Institute, as any Shiv Sena MP would to a joke about the figures in his pantheon of political deities. But would we really become more creative scientists (as Mashelkar seems to suggest) if we knocked our own deities off their pedestals every now and then? Well, anything that might instil in us the kind of skepticism that is the foundation of the scientific method is probably worth pushing along. And who knows, we might then turn ourselves into prank-pulling Feynmans who overturn the old verities and revolutionize the way we see the world.

But how do we teach ourselves to be more irreverent? And so produce better science? Mashelkar doesn't say, but he seems to have believed at one time that giving scientists all the money they want to pursue crackpot ideas might do the trick, on the principle that freedom to spend means freedom to think and work creatively. But his own experiment in generating creativity by starting a Kite Flying fund was a flop, as he seems to acknowledge himself. And all that money that the I.I.Sc. is currently awash in doesn't seem to have so far lit any creative fuses under any of its numerous recipients.

So having a pile of gold in the research kitty doesn't necessarily guarantee irreverent out-of-the-box thinking. Mashelkar himself isn't much of an exemplar of convention-busting iconoclasm. Anyone who thinks the Nano a "game-chang[ing]"¹ innovation and not just a motorized tin can could hardly be. I mean, it's not like the car operates at greater than Carnot efficiencies or gets from point A to point B by quantum teleportation. But it was built by a Tata, so it had to be the last word in automotive ingenuity. Most of us may have a similarly hard time looking beyond brands. Especially because

Your alma mater has done essentially nothing of note in the 100 years of its existence.

to speak today with anything less than gushing admiration about the holy cows in our scientific firmament is to risk the same opprobrium that every now and then derails the careers of our elected representatives. Indian science is, in fact, a lot like the Congress or the BJP parties: a big, lumbering political machine that is intolerant of dissent, suspicious of change, and steeped in the cult of personality.

We are, of course, inured to the sordidness of Indian politics, where competitive hero-worship is the norm, but if we're to do better than the Baruahs of this world ("India is Indira and Indira is India"), we need to look at people and ideas with a slightly more jaundiced eye. Since Mashelkar won't tell you how, let me.

Take the matter of scientific meetings, to begin with. At present, out of exaggerated respect for – or perhaps fear of – the coterie of éminences grises who control the levers of scientific power in the country, nearly every symposium, conference, workshop or summer school that's ever held anywhere in India – on whatever subject – tends to be packed with the same few influential people every time. But we need to persuade ourselves that a meeting on, say, string theory is best attended by string theorists and not by persons with the longest list of alphabets after their names, and if we did, we might then be able to overcome a little of our native servility.

And while we're about it, we should probably keep in mind that even the most decorated scientists in the country can and sometimes will produce work that cannot or should not be reproduced. And how better to remind ourselves of this fact than by opening a local chapter of the Ig-Nobel Prizes in India, and handing out prizes every year to the deserving. The inaugural edition of this ceremony would naturally have to be held at the I.I.Sc., an establishment that, if not quite in the same league as that place in Cambridge, can certainly be described as the Harvard of Sadhashivanagar.

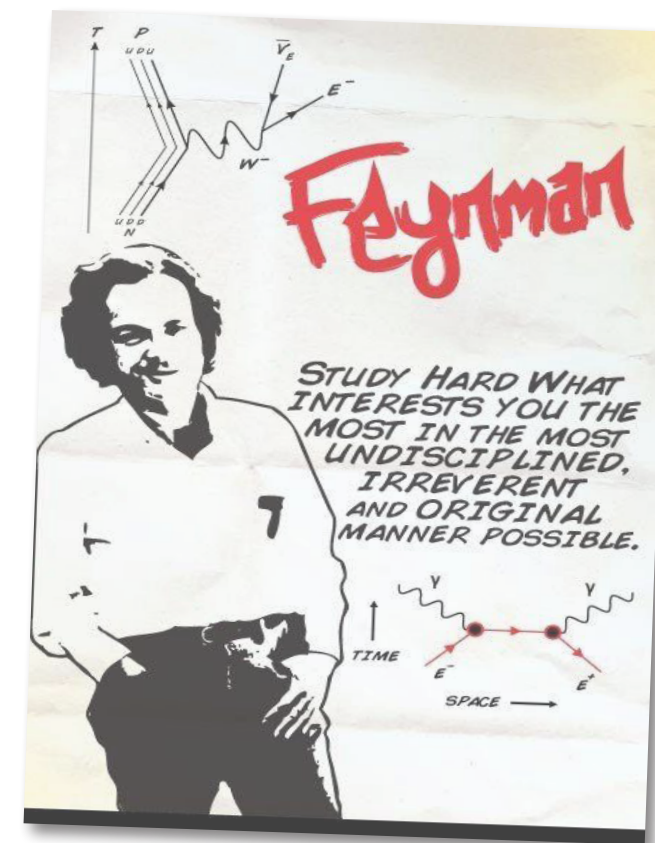
On the subject of prizes, I think we'd also do well to change the way we fete colleagues who are about to retire from office (or who "superannuate", to use that hideous word so beloved of babus.) We tend to mark these occasions with almost as much pomp and circumstance as a royal wedding, a tendency that is unlikely to promote irreverence. So in place of the symposia that we now organize in the retiree's honour, and the effusions of purple prose that accompany them, why not just substitute a T-shirt, a coffee mug, and the latest issue of this magazine. (And bear in mind, as we do

so, Mark Antony's words about burying Caesar and not praising him.)

And if none of this gets us thinking or acting irreverently, there's always the Gussie-Fink Nottle method,² which entails keeping unflattering notes on all the people we'd normally kowtow to, the idea being that once we've spotted (and duly recorded in ink) the flaws in their character, we will be less inclined to regard their every utterance as the gospel truth, and be free thereafter to think

for ourselves. After all, since even scientific superstars – perhaps especially scientific superstars – tend to have feet of clay, there's no reason to assume that when they speak ex cathedra (so to speak), their pronouncements, like the Pope's, are infallible. In fact, having just learnt that Einstein was probably the world's lousiest husband, I'm quite prepared to believe that he got general relativity completely wrong.

So watch this space for my own revolutionary new theory on the subject.



References

1. R. A. Mashelkar, Science 328, 547 (2010).
2. The Code of the Woosters, P. G. Wodehouse (Norton, New York, 2011.)

An Interview

with

Prof. V. CHANDRASEKHAR

In a wide-ranging conversation on all things great and small, a distinguished alumnus of the Institute and a past student of IPC chats with Kaushambi Mitra, Sritama Bose and Srividya Kumar about his long eventful career in science.



salubrious weather during those days and the net combination of the congenial conditions of E-block and the gentle weather of Bangalore meant that I could not get up on many occasions in time for breakfast or classes. As a result the prognosis on my career prospects was quite bleak.

You have travelled a lot throughout the country as well as to many exotic places for academic purposes. Which place would you rate as the best experience?

I have enjoyed my work at all the places where I have been, but Bangalore and Kanpur are my favourite places.

Do you enjoy teaching? How important do you think it is? Were there any teachers who played an important role in your journey towards success?

I enjoy teaching. The students of IIT Kanpur taught me how to teach and I hope I have learnt something. In my view teaching is extremely important for any academician. Contrary to the view prevalent in some circles that teaching can be a burden and impacts the amount of time one can spend on research, I have found that teaching refreshes me and gives me a sense of accomplishment. After all, research does not go very well many times — during those dark hours/days/weeks/months/teaching can be a balm and you can still feel that you are a useful member of the society.

I have had many great teachers and I am indebted to all of them.

Your favorite dish...

Chow-Chow bath

If you had not become a scientist, what do you think you might have ended up doing? Did you always want to be a scientist? As a child, which career fascinated you the most?

Which things about IISc do you miss the most?

Many things...From the collegial atmosphere to food in the mess and sports and movies in the Gymkhana — but most importantly the people I was privileged to know and interact. The most important trait of IISc was (I hope it continues to be) that no matter with whom you worked, even as a student, you could walk into any lab and discuss science. Also, at that time, even though the facilities were limited in each lab, there was ample cooperation amongst students, many times without the explicit need for intervention by supervisors.

Can you remember any funny or memorable incident(s) from your time at IPC?

I was a resident, in my initial years, of a hostel called E-block. The designers of this building, presumably, were interested in a scientific study on the effects of the absence of light (and fresh air) on its occupants. Bangalore was still boasting of its

I was (and am) interested in history and politics. I wanted to be a journalist. My father thought that I would not be able to make a decent living if I chose that career option and he gently nudged me into a more "stable" career.

What inspired you to take up organometallics and inorganic chemistry as your fields of research?

I was lucky to be selected in Prof. S. S. Krishnamurthy's lab in IPC. He is a storehouse of knowledge in all branches of chemistry and had a very broad view of science.

The training in his lab made me (and others) develop an aptitude for research. I was also lucky in later years to be associated with Prof. H. W. Roesky whose incredible enthusiasm for inorganic chemistry and organometallic chemistry can be infectious.

A quote that inspires you...

"Hands that serve are holier than the lips that pray"

A message for IPCians...

Research can be grinding and exacting and failures outnumber successes and in the end our own contribution to the vast canvas of science may be insignificant— yet research can be a fulfilling endeavor and each of our contributions adds up to the advancement of knowledge.

What differences do you see between IPC and other chemistry departments outside the country?

We need to be able to combine our strengths and work in a collaborative manner much better than we what have been doing. This is not necessarily true only of IPC but all the places in India. Modern science requires cooperation and collaboration between various research groups. This is happening in some way, but needs to be a regular feature.

Can you say something about the changes that IPC has undergone in the past 3 decades?

IPC was not the blue-chip stock of the Institute in the 80s. Other departments, notably MBU, hogged the limelight. The facilities and infrastructure three decades ago was still quite moderate. These have improved enormously in the

last three decades.

As a student what were your dreams and aspirations? Do you feel you have realized them?

Students of my generation were of the pre-liberalization era and were conservative even to dream big. If somebody had forecast that I would be a Professor during my Ph.D. days I would have given him/her a treat (being fiscally conservative, the treat would have been in Janata Hotel, Malleswaram).

How do you think we can improve scientific research in India?

The biggest problem that is confronting young Ph.D. students today is lack of enough opportunities. Although we have over 500 Universities, many of them prefer to selectively pick people who are not necessarily on the top of the heap. And, our industry is not hiring enough Ph.D.s. Hopefully this scenario will change and Ph.D.s will have more avenues.

We don't see lot of female professors, especially in experimental chemistry. Any comments? Any special message to young women researchers?

I hope it will change because there are many young female students pursuing their Ph.D.s now. Also, since the attitudes of society are also changing I am sure that there will be many more female professors in our academic institutions in the years to come.

As faculty positions are highly competitive these days, what do you feel about students opting for non-academic careers after a PhD?

I see no difficulty in students choosing among various career options available to them. A Ph. D does not tie you down to an academic career. The Ph. D programme trains one to acquire both analytical and synthetic skills, which can be harnessed fruitfully in other career options also.

ALMOST THERE....

For research students the departmental colloquium is the last but one milestone on their road to a Ph.D. The following students reached this milestone in the past year, and the titles of their presentations and the dates they were given can be found here.

Debdyuti Mukherjee (Sampath Lab)
Jan. 20, 2017
Electrocatalytic Studies using Transition Metal Thiophosphates, Metal Chalcogenides and Polymers

Aderonke A. Adeyemo (Mukherjee Lab)
May. 2, 2017
Self-assembly and Cytotoxic Activity of Homometallic and Heterometallic Coordination Architectures

Brij Kishore (Munichandraiah Lab)
May 12, 2017
Electrochemical Investigations Related to the Next Generation Na and K Batteries

Ramaraj A. (Jagirdar Lab)
Sept. 16 2016
Activation of H-X (X = H, Si, B, C) Sigma Bonds in Small Molecules by Transition Metal Pincer Complexes

Amit Gupta (Vasudevan Lab)
Apr. 18, 2017
Aqueous and Non-Aqueous Dispersions of MoS₂ Nanosheets

Surajit Kayal (Umapathy Lab)
May. 5, 2017
Understanding Ultrafast Structural Dynamics of Molecular Systems in Condensed Phase: Ultrafast Raman Loss and Transient Absorption Study

Srividya Kumar (Umapathy Lab)
May 19, 2017
Micro-spectroscopic studies on Identification and Understanding of Mycobacteria and Cancer cells

Neena K. K. (Thilagar Lab)
Jun. 29, 2017
A New Class of Boron-Nitrogen Compounds: A Rational Approach for the Design and Development of Smart Materials

Arnab Bhattacharyya (Chakravarty Lab)
Jul. 14, 2017
Studies on Photoactive BODIPY Complexes of Copper and Zinc as Anticancer Agents

Gaurango Chakrabarty (Mugesh Lab)
Jul. 25, 2017
Cyclic Dichalcogenides as Redox Modulators: Synthesis, Structure and Glutathione Peroxidase Activity

Bijaylaxmi Athokpam (Sai G Lab)
Jul. 31, 2017
Theoretical Investigation of H-Bonded O-H Vibrations, H-atom Transfer and C-H Vibrations via Empirical Valence Bond and Local Mode Based Models

Vaishali A. (Vasudevan Lab)
Jun. 12, 2017
Aqueous and Non-Aqueous Dispersions of Graphene and Boron Nitride nanosheets

Ancila Urumese (Jagirdar Lab)
Jul. 7, 2017
Zeolite Imidazole Framework-8 (ZIF-8) Supported Nanoparticles: Synthesis and Applications

Suresh Kumar Perala (Ramakrishnan Lab)
Jul. 21, 2017
Orthogonally Functionalizable Hyperbranched Polymers (HBPs): Uses in Amphiphilic Hydrogels and Supported Catalysis

Samir Kumar Sarkar (Thilagar Lab)
Jul. 27, 2017
Triarylborane-BODIPY Conjugates: Small Anion Recognition, White Light Emission, Multi-color Cell Imaging and High Efficient Small Molecule Solar Cells

OLÀ, GOA!

Somarupa Sahoo, The Elixir's travel guru, rhapsodizes about a memorable trip to Goa with the Al(l)Chemists' Club.



A vacation is what you take when you can no longer take what you've been taking.

- Earl Wilson

Which pretty much explains why the Al(l) Chemists' Club took up the gargantuan task of transporting, handling and entertaining 60 odd mad-scientists-in-the-making to an equally crazy destination: GOA.

There is not a soul who doesn't have a failed Goa plan during college days in his kitty. Legend has it that you have to offer sacrifices to the Gods of the seven kingdoms, standing on one leg for 24 years for the plan to become reality. And naturally, when the idea of going to Goa first popped up in our club meeting, everyone shook their heads in dismissal. We don't have the budget they said. Plenty of things can go wrong they said. It will be tough to manage such a huge crowd in that city they said. Ghosts of the last trip began to haunt us at nights. But we're researchers after all – no strangers to the concept of things going haywire. So we rolled up our sleeves and got things moving. The tickets, the itinerary, all the nitty-gritty details of organizing an excursion – everything was chalked out. We were now *definitely* going to Goa.

We started off with an overnight train journey to Londa followed by a 3 hour bus ride on winding ghat roads. And when, inevitably, people became restless during the ride, guess who came to our rescue? Shah Rukh Khan! Someone played DDLJ on the screen and voilà, pin-drop silence.

After reaching Goa, we first headed to the Palm resorts on Calangute beach, our base camp for the next 3 days. Everyone changed into floral and colourful clothes, all set for the fun to begin. Our first stop was Fort Aguada, which gave us a glimpse of the unique Portuguese architecture of the region. There was a lighthouse, a closed central jail and a breathtaking view of the sea dotted with fishermen's boats – just the right ingredients for the perfect photo-ops with our selfie sticks and DSLRs! Next up was the Immaculate Conception Church. This baroque Catholic church atop a small hill had a grand façade and was beautifully lit up at night. Thanks to the yearly carnival going on at the time, the city itself wore a festive look. In the evening, we were aboard "The Lexicon", a three decker open air cruise yacht on the Mandovi river. There was a mini disco and good music, so needless to say, we IPCians were all over the dance floor in a jiffy.

The next day started with a trip to Old Goa. This part of town was much quieter, with some churches and pebbled roads lined with quaint little handicraft shops. We visited the Basilica of Bom Jesus, a 16th century church built, again, by the Portuguese. True to its UNESCO world heritage tag, it was a work of art and held the mortal remains of St. Francis Xavier. Right in front of this church was the Sé Cathedral, one of the largest churches in Asia. Then we headed to the Dona

Paula cliff, also known as lovers' paradise, where some of us tried our hands at jet skiing and dolphin watching. The next stop was Miramar Beach, which offered us nothing more than this group photo. At this point, we all had had enough of history lessons, and we were now unified in our craving for BEACHES!

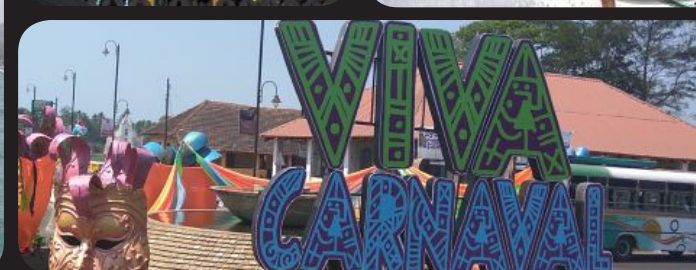
So we headed back to Calangute, and rushed into the water like we had been stranded in the desert for a year. The beach was a lot like our very own Yeswanthpur – crowded and earthy. Play, tease, shout, fall, swim: you could do it all. We were supposed to be adults, but we frolicked in the water like 3 year olds, taking in the majestic Arabian Sea in all its glory! Late in the evening, some of us went back to the resort (to bond over dumb charades), and some of us hit the beach-side shacks for seafood and "beverages". And later still, a few of us hired bikes, explored the Saturday night market in Arpora (a paradise for female shoppers!), and followed it up with a trip to the Anjuna rock beach. The rest of us ended up at a happening neon-lit nightclub named Cubana. Everywhere we went we experienced Goa's special vibe, a beautiful mix of contagious energy and soothing calm. And the shops stayed open till 2 am! Whether you wanted biryani, a haircut or a can of petrol,

you never had to worry about the time.

Our final day in Goa was reserved exclusively for Baga beach, aka the "Golden Beach of Goa," where the sand glitters like gold. The place exudes a kind of elite charm, and is packed with foreigners and colourful beach beds. Everyone indulged in a variety of water sports: banana rides, bumper rides, jet-skiing, paragliding. Eventually, the sun glowered above our heads, signaling that it was time to go home. With a heavy heart, we bid the ocean adieu, and started the journey back home. In the bus, there was an impromptu round of fish that included some leg pulling, some revelations of secrets, and lots of appreciation for the first year ladies!

So all in all it was a very smooth trip. I cannot of course elaborate on the censored activities that also went on over there (wouldn't want to earn the wrath of my fellow IPCians or er.. a jail term.) What happens in Goa, stays in Goa!

Now, back to research and a long, long wait for the next adventure. Over to you, new Al(l)chemists. It had better be good the next time too!



IPC DAY(S) 2017

A two-day symposium – IPC Day 2017 – was held on the 27th and 28th of January 2017 to showcase the ongoing research activities of the Department. The symposium has become an annual fixture of the IPC calendar that provides students and faculty of the department an opportunity to discuss their latest research findings with the wider Institute community. It features oral and poster presentations covering a diverse range of topics in Inorganic and Physical Chemistry, from electronic structure calculations at one end to supramolecular synthesis at the other.

This year IPC Day had six scientific sessions over the two days of the event, and among the talks presented were the following: “Redox signalling and oxidative stress”, by G. Mugesh, “Femtochemistry of heterogeneous nanocatalysis”, by A. Bhattacharyya, “Estimation of amino acid pKa values using molecular dynamics simulations”, by S. Vasudevan, “Noble metal nanoparticles” by P. K. Das, “Self-assembled molecular flasks” by P. S. Mukherjee, “From polymer folding to 2-D polymers”, by S. Ramakrishnan, “Iridium pincer complexes”, by A. G. Samuelson, and “Bond currents in molecular junctions”, by U. Harbola. In addition to these 8 faculty talks, there were 13 student talks, and 2 talks by alumni of the Department (“Development of cost-effective catalysts”, by Swadhin Mandal from IISER Kolkata, and “Spectroscopy of atmospheric processes” by Rajakumar from IIT Madras.) The six sessions of oral presentations were chaired by distinguished faculty of the

Institute, including S. Natarajan, V. Krishnan, S. S. Krishnamurthy, K. C. Patil, Dipankar Nandi and D. N. Satyanarayana.

Apart from the science, IPC Day also featured a smorgasbord of tasty eats on both days that managed to satisfy even the most fastidious palates. The event concluded with a gala dinner on the lawns of the Jawaharlal Nehru Guest House, where “beakers full of the warm South” added piquancy to the kebabs, curries and pulaos that were on offer.

– Ria Mukherjee



A Celebration of the Scientific Contributions of Prof. Munichandraiah and Prof. Jemmis

No person was ever honored for what he received.
Honor has been the reward for what he gave.

–Calvin Coolidge



On July 31, 2017, two of IPC's most distinguished members, Prof. Munichandraiah and Prof. Jemmis, will officially retire from service. In recognition of their contributions to the Department and the Institute, a scientific symposium in their honour was held on July 4th and 5th on the theme of Recent Advances in Chemistry. Organized by Profs. Arunan and Sampath, the symposium showcased research in electrochemistry and structure and bonding that students, colleagues and associates of Profs. Munichandraiah and Jemmis have been carrying out over the years in different parts of the country. The talks presented at the symposium spanned a wide range of topics, from the lifetime of lead acid batteries (A. K. Shukla, I.I.Sc.) to the modelling of charge transfer processes (M. V. Sangaranarayanan, I.I.T. Madras), and from the anatomy of the B-B bond (M. M. Balakrishnarajan, Pondicherry University) to spectroscopic shifts in hydrogen bonds (S. Wategaonkar, I.I.T. Bombay.) They were a reflection of Prof. Munichandraiah's and Jemmis's own wide-ranging interests, which they elaborated on themselves in the concluding talks of July 4th and 5th.

Professor Munichandraiah joined IPC on 4th July, 1977, exactly 40 years before the date of the RAC Symposium. Professor Jemmis joined the department

much later, in 2005, working here for 3 years before taking a five-year leave of absence to set up and lead the Indian Institute of Science Education and Research, Trivandrum, and then returning at the end of that period to the I.I.Sc., where he has been since, and where he will remain for several more years as an honorary professor.



The Symposium was followed by a felicitation function for the two honorees, an occasion for their friends and well-wishers to share memories and reminisce about the good old days. Prof. Munichandraiah was universally remembered as a man of few words and a person of unimpeachable integrity. Prof. Jemmis was described by one colleague as eternally youthful, and by another as someone with an abiding interest in all aspects of departmental life, social and scientific. He and his wife Alice's determined and hospitable efforts to make IPC a less insular place were fondly recalled by everyone who spoke.

A lavish outdoor buffet dinner at the Jawaharlal Guest House was the culmination of the symposium's proceedings. A sudden and unexpected monsoon shower was an uninvited guest at the event, but it did nothing to dampen spirits or interrupt the “feast of reason and the flow of soul”.

– Aman Jindal

IPC



Then and Now

- Prof. K. C. Patil

Both the Indian Institute of Science (IISc) and the Department of Inorganic and Physical Chemistry (IPC) are over a 100 years old. In the life of a nation, a hundred years is nothing, but for an Institute, a century is a milestone, and long enough to make a significant impact. I have been associated with the IPC Department for almost half a century. I joined the department as a CSIR Pool Officer in 1972, and retired in 2002 as a CSIR Emeritus Scientist. I continue to be a part of the department, courtesy of the faculty and students. For the purposes of this article, 'then' is the last quarter of the 20th century, and 'now' is the 21st century.

IPC Then

In the 70s, IPC had already celebrated its diamond jubilee, and was one of the oldest chemistry departments in the country. It had a large faculty (nearly 20), as well as supporting staff, office staff, lab assistants, technical assistants and students. The faculty were grouped into four divisions according to their discipline of research. The groups were led by a senior professor:

1. Theoretical chemistry and spectroscopy - Prof. C. C. Patel.
2. Electrochemistry - Prof. A. K. N. Reddy.
3. Main group elements; solid state chemistry; and mineral chemistry - Prof. A. R. Vasudevamurthy.
4. High energy solids - Prof. V. R. Pai Verneker. Other members of each group were all also well-known, and had contributed significantly.

There was a good workshop with lathes, mechanics, carpenters; an analytical lab; glass blowing facility; gas plant and maintenance staff. But the department lacked modern instrumentation and infrastructure. Instruments like IR, UV-Visible, NMR, mass spec, Mossbauer and computers were all old, and housed in CISL (Central Instrumentation and Services Lab), where they were used by all the students in the Institute.

The IPC building and labs needed repair and renovation. The tiled roof used to leak in the rainy season, and the corridor was dark, with poor lighting. Walls in the corridor had exposed gas, water pipelines and electric cables. There were open drains in the labs covered with wooden planks. Often, rats and snakes gained access to the labs through these drains. There was no internet, computers (PCs)

or xerox machines, and very few telephones. Students used 2-pan balances, and a couple of single-pan (Mettler) balances were kept as a common facility near the then IPC office (present ice room). Most of the instruments like TG, DTA, Gouy balance, X-ray, NQR etc. were indigenously developed and manually operated. Everything used to move at snail's pace. All this led to delays in completing PhD work, and getting a degree typically used to take 5-6 years.

Unlike the Indian Institute of Technologies (IITs), which were established in the 1950s with foreign collaboration and funding, IISc/ IPC did not have enough funds or foreign exchange to buy modern instruments and carry out research of international standards. Funding was required to repair, renovate and modernise the infrastructure. The last quarter of the 20th century was a period that saw improved facilities



ties and renewed creativity. Several senior faculty members retired, and young faculty were recruited to work in new emerging areas like polymer chemistry, organometallics,

bioinorganic chemistry, catalysis and inorganic solid state chemistry. Funding became available from UGC, DST, DRDO, ISRO and UNDP (United Nations Development Programme). Many modern instruments like Perkin-Elmer IR, laser Raman, atomic absorption, NMR, TG, DTA, DSC, GC-MS, vibrating sample magnetometer (VSM), single crystal X-Ray, BET surface area measuring instrument (Quantasorb Corpn.), CHN analyser, etc., were procured and installed. This required a lot of money and effort from the faculty as the old IPC building, with its high tiled roof, was not suitable for air-conditioning of the instrument labs. The IPC Annex was built, and old labs were modified. With the revolution in information technology (IT), internet became

available, PCs cheaper, communication and publishing of papers became easy and fast. This resulted in improvement in the quality of research. Significant contributions were made in new areas of research, such as polymer chemistry, co-ordination chemistry, bioinorganic and organometallic chemistry, theoretical chemistry, electrochemistry (Ni-Cd batteries) and nanomaterials. Some of the faculty members received recognition, and were rewarded with academy fellowships, memberships of editorial boards of national and international journals, Bhatnagar Award, etc. However, the image of IPC Department was still not very good, as indicated by fresh PhD students opting for other departments in the Chemical Science Division rather than IPC.

attracts bright and young faculty and students. The atmosphere in the department is ideal to do original and creative research. As Isaac Newton once said, "If I have seen further it is by standing on the shoulders of giants". IPC Department is doing excellent work in this century due to the firm foundation laid by the faculty and students in the last century.

IPC Now

IPC in the 21st century looks bright and promising. The Department has nearly 20 faculty members, most of them young, intelligent and enterprising. There are 120 research scholars and a number of research associates. The Department is receiving good funding, and individual faculty have large research grants (crores of rupees!) and travel frequently by air in India and abroad to attend seminars, symposia and conferences. The faculty are doing excellent research in the current and emerging areas. Today, there are half a dozen Bhatnagar prize winners in the Department, and the faculty are on the editorial boards of prestigious national and international journals. Some are also in high positions in the Institute's administration. Research publications have increased and are highly cited. IPC celebrated its centenary in 2009.

Many of our alumni are abroad, or have joined other premier Institutes (IITs, IISERs etc.) of higher learning in India. The Department's image has changed dramatically, and now



Personally, I have benefited greatly as I have been able to do more creative work, even after my retirement. Our work on "solution combustion synthesis (SCS) of nano oxide materials" carried out in the last century has become relevant today and is highly cited. An Indo-Russian workshop on "Combustion Synthesis" was organised under the auspices of IPC and MRC in 2008. IPC also celebrated silver jubilee of SCS in 2013. We have written two books on the subject, which have been published by Wiley and World Scientific Singapore. Being in the department and using the Institute e-mail ID, I could continue to be in touch with

the outside world and get invitations to attend conferences in India and abroad (Singapore, China and Russia).

IPC Tomorrow

New Chemical Sciences Building under construction





Since my research field is based on the delivery of anti-cancer drugs, I frequently work with human cancer cell lines. The most abundantly used among them, is of course, HeLa. This is evident from the fact that countless research articles in the cancer biology or biological chemistry fields contain the word HeLa. But most of us probably only know that HeLa is a human cervical cancer cell line, or that it is named after the donor Henrietta Lacks. For a long time, that was the extent of my knowledge too. Now that Rebecca Skloot has penned the book “The immortal life of Henrietta Lacks”, HeLa’s real significance and its long and interesting back story have finally (and beautifully) been told.

As I slowly flipped through the book’s pages, I got to know more about the history of America’s long-prevailing racism. The author bluntly describes the inhuman treatment meted out to blacks of Henrietta Lacks’s era (the early part of the 20th century.) They were often deprived of basic medications and were labelled an inferior class solely because of their colour. Being poorly educated, they were taken advantage of, and were frequently used, without their consent, as guinea-pigs by white scientists. However, in those times, there were no laws restricting doctors from doing so, so blacks had no way of seeking redress. At the same time, as the book makes clear, there were other scientists who worked devotedly to develop innovative new drugs and to discover new dogmas of life. Against this backdrop, Rebecca Skloot skillfully

puts together the various pieces of Henrietta Lacks’s life and death, and her part in the creation of the HeLa cell line. In writing this story, Skloot herself connected with the Lacks family, and developed an emotional bond with them, befriending Deborah Lacks, Henrietta’s daughter, and working with her to let the world know about the African-American woman whose cancerous tissue was unwittingly excised to develop the first in vitro human cell culture.

Very recently, a movie based on the novel was aired on HBO. On a promotional basis, and also because Virginia was the hometown of Henrietta Lacks, the movie was pre-screened on the campus of the Virginia Commonwealth University, where I now work. I was fortunate to be there at the time of the screening. The ninety minute film was much more than a science documentary. While the book was an exhaustive description of the young author’s adventures and her indomitable quest to learn the history of the long-forgotten woman whose involuntary contribution changed the face of medical science, the movie, on the other hand, focused more on the personal bonding between Deborah and Rebecca. It sketches the struggles of a woman who is



1951: BIOPSY
Tissue was taken from Henrietta Lacks without her knowledge.

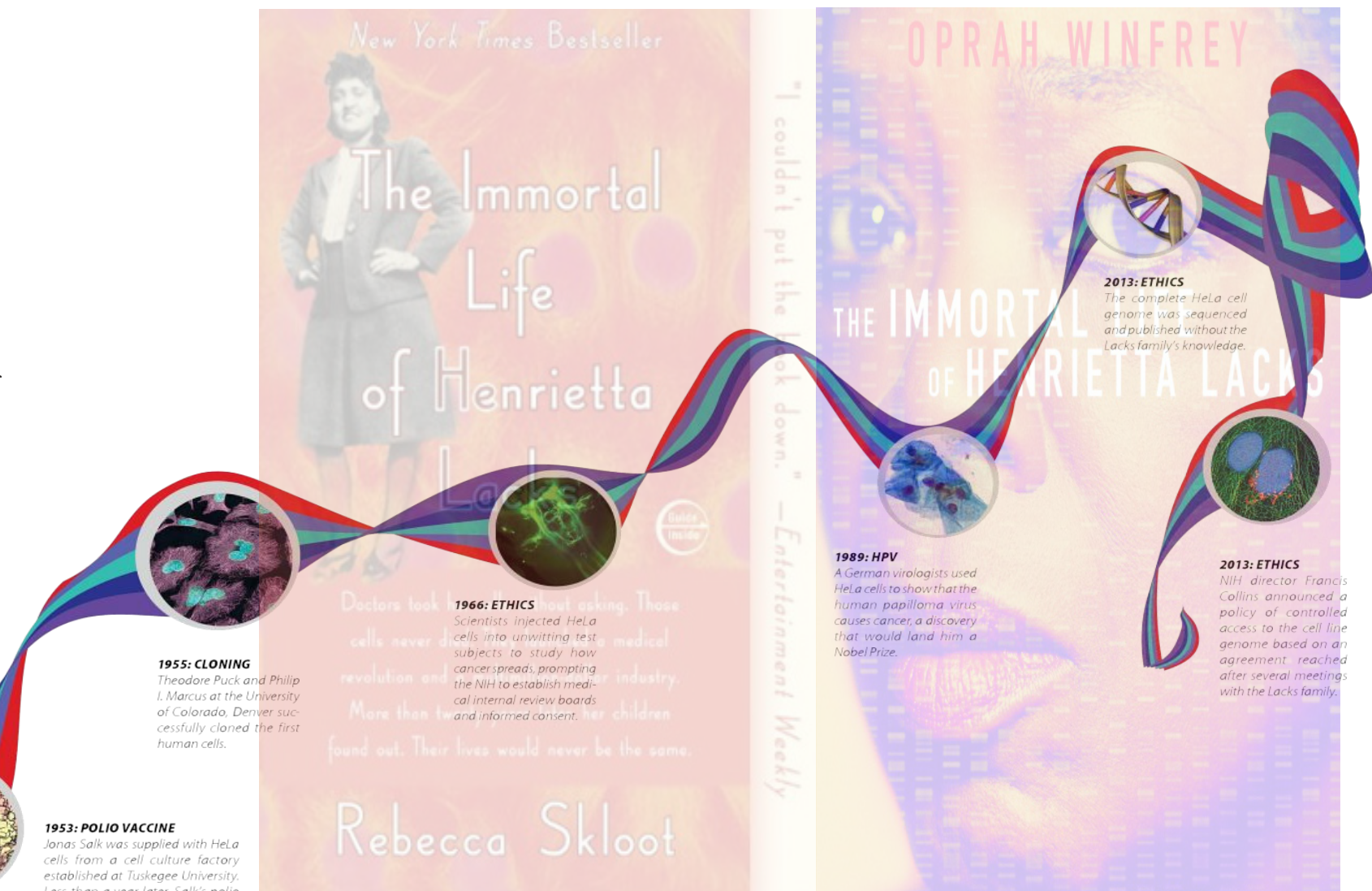
1955: CLONING
Theodore Puck and Philip I. Marcus at the University of Colorado, Denver successfully cloned the first human cells.

1953: POLIO VACCINE
Jonas Salk was supplied with HeLa cells from a cell culture factory established at Tuskegee University. Less than a year later, Salk’s polio vaccine was ready for human trials.

deprived of parental warmth and affection at a very tender age, and who desperately attempts to cling to any memories of her mother. Deborah also finds out the horrible fate of her younger autistic sister, Elsie, whose existence was concealed from her. Lacking a proper education, Deborah failed to understand or appreciate the arcane science behind HeLa cells. She was more inclined to believe the questionable science articles that appeared in popular magazines. In time, she became severely ill herself, prone to terrible mood swings, and to a deepening sense of personal insecurity and feelings of exploitation. All these circumstances, as well as the issue of race, made it hard for Rebecca to win Deborah’s trust. The movie is all about their voyage to explore the bitter truths that were hidden for ages in the mists of arbitrary notions and distorted facts. Winfrey Oprah, starring as Deborah Lacks, delivers a captivating performance and emerges as the show-stealer. Her facial expressions, body language and thoughtfully delivered lines breathed life into the “oddly charming quirks” of her real-life counterpart. Since I was then in Virginia myself, I also had a special

connection to the film and its cultural milieu, as I could easily identify all the places it referred to, like Roanoke, Clover and Baltimore.

In a nutshell, this real life narrative/movie exposes the reader/viewer to contrasting perspectives. On the one hand, it tells us about the deeply embedded racism of the America of the early 20th century, and of the exploitation of its financially weak and uneducated black population. On the other, it is also the story both of a white woman’s efforts to bring justice to the family of Henrietta Lacks, and of the many scientists who in the name of science and at some cost to themselves carried out unauthorized but legal experiments on human subjects. The Lacks family was mostly oblivious to the colossal scientific benefits that accrued from their bloodline, and sadly received few direct personal benefits from it. But being religious, they appear to have believed that these developments were pre-destined and that Henrietta was in some way chosen to sacrifice herself for the good of mankind. I will leave it the reader to decide whether she was rather the victim of a grave injustice.



OUR NEWLY MINTED DOCTORATES

WELL DONE!

Over the last year, from August 2016 to July 2017, the following students were awarded Ph.D. degrees:

Rahul Kumar (Jagirdar Lab)

Santanu Mondal (Mugesh Lab)

Bijan Roy (Mukherjee Lab)

Etim Emmanuel Edet (Arunan Lab)

Ahamed Irshad M. (Munichandraiah Lab)

Sourav Ghosh (Jagirdar Lab)

Nara Siva Krishna (Nethaji Lab)

Ravi Kumar V. (Umapathy Lab)

Anup Kumar Pramanik (Samuelson Lab)

Anju V. G. (Sampath Lab)

Rajendra Kumar G. (Thilagar Lab)

Aniket Chowdhury (Mukherjee Lab)

Himangshu Prabal Goswami (Harbola Lab)

Srilakshmi P. Bhaskar (Jagirdar Lab)

Raja K. (Mugesh Lab)

Sananda Chanda (Ramakrishnan Lab)

Aditya Garai (Chakravarty Lab)



TRANSITIONS

(OH, THE PLACES YOU'LL GO)

Following the completion of their Ph.D.s, these students have moved or are moving to new assignments as post-doctoral fellows:

Bijan Roy
Post-Doc Fellow at Dr. Abhishek Dey Group, Department of Inorganic Chemistry, IACS, Kolkata.

Ahamed Irshad M.
Post-Doc Fellow at Prof. S. R. Narayan's group, Department of Chemistry, University of Southern California, Los Angeles, USA.

Himangshu Prabal Goswami
Guest Scientist at Dr. Alexander Einfeld's Group, Max Planck Institute for the Physics of Complex Systems Division of Finite Systems, Dresden, Germany.

Etim Emmanuel Edet
Lecturer at Department of Chemical Sciences, Federal University Wukari, Taraba State, Nigeria.

Ravi Kumar Venkatraman
Newton International Post-Doc Fellow, Prof. Andrew J Orr-Ewing's group, School of Chemistry, University of Bristol, UK.

Rahul Kumar
Post-Doc Fellow at Dr. Anukul Jana's Group, TIFR Hyderabad.

Sananda Chanda
Solvay Specialities, India Pvt Limited R&I Centre, Vadodara, Gujarat.

A Chat with Dr. Manisha Mukherjee, an Alumna of IPC

It was a wonderful experience interviewing Dr. Manisha Mukherjee, a former student of IPC who earned a PhD from the Department in 1976, and who is now no longer actively involved in research.

The Q&A

“Getting a higher degree helps us to teach better”.

“I was never interested in Science. I did Ph.D. because I loved the degree. I joined IISc as my husband was here, but I was always interested in teaching, and I feel getting a higher degree helps you to teach better.” That in a nutshell is the essence of the short, but memorable discussion we had with this alumna of the Institute. In her other remarks in the interview we conducted with her, she showed the same refreshing degree of candor and spontaneity.

The Elixir: Good afternoon ma'am. First of all welcome back to IPC! Would you mind if we recorded this conversation?

Manisha Mukherjee: No, no don't record! Because I have forgotten my thesis title also.

(But after some urging, Dr. Mukherjee relented, and allowed our conversation to be taped.)

TE: When were you in IPC? Who was your guide?

MM: I was here during the end of 1970 to 1976. I worked with Prof. R. S. Subramaniam. I worked on something related to potentiometry, but I don't remember my thesis title right now. In those days, thesis used to be in typed format. Unlike these days, thesis used to be very fat. So while returning to Kolkata, I did not carry it with me among my other things. Anyway, library will have one copy. I only have my certificate with me. That also I lost for some time, though again I found it. That's all.

TE: Can you tell us something about your guide and your former labmates?

MM: No, no we never discuss about professor. I don't like discussing about professor.

TE: Where are you located now? What did you do after your Ph.D.?

MM: Now I am in Calcutta. After my Ph.D., first I was involved in a project in the Chemical Engineering Department. Then we went abroad and came back to India. Then I taught as an honorary teacher in Tata Institute Central

School. Then I joined ASC Central School. I was always interested in teaching 11th and 12th standard students. But it was too far and I had some family commitments also. My mother-in-law was my grandmother's age and very old, and my children were also there. I had to look after them. Those days, the first priority was – there should be peace in the house – so I resigned.

TE: Doing a Ph.D. in the 70s was probably very rare for girls. Do you remember the ratio of boys to girls at that time?

MM: We never enquired how many boys were there. I was already married. So I was not interested in boys! But quite a number of girls were there at that time also.

TE: Your native place was Kolkata. And you had to come all the way to Bangalore for your Ph.D. What was the reason?

MM: My husband, Professor A.K. Mukherjee, joined as a faculty in Chemical Engineering Department. After marriage, I had to follow my husband. That was the reason.

TE: After your Ph.D., you did not pursue a career in research. Any special reason?

MM: I was never that much interested in research. But I was always interested in teaching, but not in undergraduate and graduate level. I love to teach 11th and 12th standard students.

TE: It's sometimes said that you don't really need a Ph.D. for teaching. Do you feel that having a Ph.D. helped your teaching?



MM: Why not? I got teaching post from Ramaiah College also. They only take Ph.D. degree holders for teaching. Some people go for double Ph.D. also, because they are interested in that subject. It's all about your interest.

TE: Given a chance, would you now like to return to teaching or to a professional life?

MM: Now I have lost all my contacts. I will never come back to research again. I can teach 11th and 12th students though, not higher than that. They used to like me a lot. I loved to teach.

TE: We would really like to know something about life at I.I.Sc. during your time.

MM: At your young age, anywhere you go, you will like that life, because young students can't see the ugly side. That comes with age. Now I may say something, but those days I enjoyed every moment. I liked the weather and I.I.Sc. environment. I had very good seniors also. I remember Dr. Vijayalakshamma and Dr. Bhatt very well. Dr. Subba Rao was also there who went somewhere else after his degree. I really loved the time here. All of you will remember this time period for your entire life.

TE: You have come back here after 40 years. What are the major changes that you see now?

MM: Bangalore itself has changed. It looks posh. We never had this type of conference table or anything. Even projector was not there. I did not have a table also. I used to keep my books on stool kind of thing. On that I pinned some chart with nail only (not even with a pin!). But now it is completely different. Now I could not find my lab. It has changed a lot. Our lab was near the staircase, after Prof. Patil's lab. Probably now it is someone else's lab.

TE: Any fond memories of that past life that you would like to share with us?

MM: I remember I used to collect stamps. Even now, I collect stamps. And our professor never allowed us to take stamps

from letter box. So I used to search in the garbage box, to see if the other professors had thrown anything. One day the then Chairman, Prof. Vasudev Murthy, saw me collecting stamps from the garbage can, and I told him, 'Our professor does not give us stamps!'

TE: Seeing the I.I.Sc. again after so many years, what do you like the most about the changes?

MM: Only today I came here. I did not have time to look into everything. Bangalore climate was never healthy, but Bangalore weather is something one will always like. There are so many trees now. It was not that way much earlier. I liked the improvement in department infrastructure, particularly the wash rooms. That time, it was so dirty. Now it is nice.

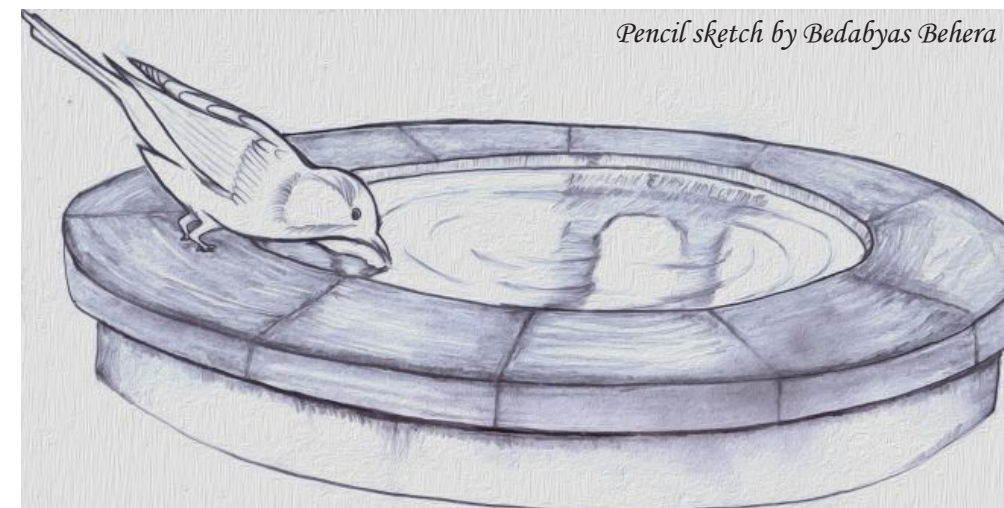
TE: Are there any changes or improvements that you would have liked to see, but that haven't been made so far?

MM: Since I was never very involved with administration, I did not go very deep into that. Unless I go very deeper I should not comment superficially. After all, I am not a politician. Seeing you children, I feel department is doing a very good job. You are not like very modern, very dashing, pushing and that type of thing. I feel that same type of spirit is still continuing in the department. I like that.

TE: Finally, what message would you like to give us?

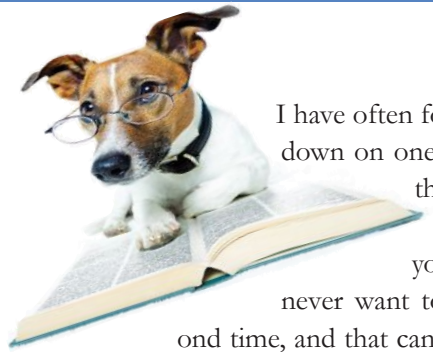
MM: All of you should shine in life, and of course you should remember your department throughout your life. That is the only message I would like to give. We always feel some kind of bonding with the department.

- Ria and Sudeeksha



Review : Fever, by Robin Cook

Another cancer-themed book goes under the literary microscope



I have often found that literary critics look down on one particular genre of writing: the murder mystery, or the thriller. They say that once you know 'whodunit', you will never want to return to the book a second time, and that can be a hurdle to its becoming a classic or even being critically acclaimed. Yet whenever an opportunity to dip into a nice fat juicy thriller presents itself, I can never resist the temptation. And if the thriller deals with the world of medicine, making it effectively a work of "science fiction", then I suspend my analytical faculties and let my inner critic take a holiday!

Of course there's only one writer of medical thrillers, and that's Robin Cook. *Fever* is the first of his books I ever read, and having enjoyed it immensely, it was a natural choice for the subject of this review. It tells the story of Michelle Martel, a 12-year old girl with acute myeloblastic leukemia, and the struggle of her family (in particular her father, Charles Martel) to save her life. Charles is a dedicated scientist, and is the actual protagonist of the novel. He works as a cancer researcher at the fictional Weinberger Institute in Massachusetts, where he hopes to show that immunotherapy will some day be the best weapon against the disease. Charles lives in a small town in New Hampshire with his 3 children (Michelle, Jean Paul and Chuck) and his second wife Cathryn, the loving (yes, loving!) stepmother of the kids.

The novel begins with Michelle coming down with what seems like a common cold and fever. But when the fever persists, an anxious Cathryn takes her to the hospital, where she's diagnosed with advanced stage leukemia. She's started on chemotherapy, but Charles is doubtful of its efficacy, having seen his first wife suffer and die of the same disease after a prolonged course of chemotherapeutic treatment. He is overwhelmed to find history repeating itself, and though he believes that his daughter's treatment will only increase her own suffering, he is unable to convince either his wife or the doctors to discontinue it. As if this were not misery enough, Charles accidentally discov-

ers that the water near his house where Michelle used to play is contaminated with benzene, a chemical he is aware is carcinogenic. Charles tracks the source of benzene to the Rubber Recycling Plant, which he later finds is owned by the same parent company that runs the Weinberger Institute. Charles is outraged. Risking his job, his reputation, his family life, and everything else he holds dear, he embarks on an epic battle to save his daughter's life and to demolish the Rubber Plant. In the end, his determined struggle against corporate wrongdoing and his persistent efforts in the lab to find a cure for cancer pay off, and he eventually succeeds in ridding Michelle of the disease. The administration of the Institute acknowledges the importance of his work, and he finally receives the respect he deserves. To top it all, his bond with Cathryn and his other two children (who were beginning to suspect his sanity) becomes stronger. So the novel concludes with the proverbial (and desired) happy ending!

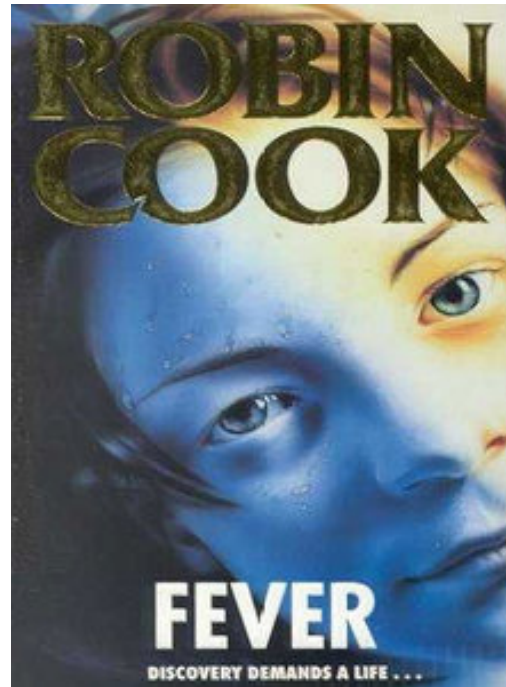
This is not to say the book is perfect, and I have to mention some of the things I didn't much like about it. First of all, the story sometimes feels like a superhero fantasy. The way Charles single-handedly fights crooked cops and corrupt officials strains credibility. Then there's the character of Cathryn; in the author's portrayal of her, she's just too good to be true, with no faults at all, with none of the complexities of

real individuals. (Perhaps Cook had to make her saint-like to compensate for Charles's character deficiencies.) It's also difficult to be persuaded that Charles could set up a research laboratory in his home and with minimal facilities find a cure for Michelle's aggressive leukemia. Thirty-five years after *Fever* was written, we're still far from achieving such a goal.

Overall, the pace of the story and the gripping plot make this book hard to put down. The prologue deserves a special mention; it makes you visualize the way benzene molecules invade the bloodstream like terrorists and then attack and mutate the stem cells' DNA.

So to all you 'thriller' and 'sci-fi' buffs out there, if you haven't read too many Robin Cooks already, I would strongly recommend that you put *Fever* in your bucket list. You're bound to enjoy it!

- Nandini Mukherjee



IPC in the NEWS....



The Indian Institute of Science (IISc) as it celebrated its Open Day. (TOI File Photo)

বিশ্বেদারক খুঁজবে ক্ষুদ্রাণু কৃতিত্ব বাঙালি বিজ্ঞানীর

অর্পিতা মজুমদার



পার্সারথি মুখোপাধ্যায়। নিজস্ব চিত্র।

বিশ্বেদারক খুঁজতে পুলিশ-কুস্তুর নথি, এ বার কাজে লাগবে রাসায়নিকের অতিক্ষুদ্র কণা! চলতি ভাষায় যাকে ক্ষুদ্রাণু বা 'ন্যানো-মিনিকিউল' বলা যায়। ক্ষুদ্রাণু দিয়ে বিশ্বেদারক খোঁজার কাজ করে চলেছেন বঙ্গসন্তান পার্সারথি মুখোপাধ্যায়। যে গবেষণার জন্য এ বছরের শান্তিধরপুর ভাটনগর পুরস্কারও পেয়েছেন বঙ্গসন্তান ইন্ডিয়ান ইনস্টিটিউট অব সায়েন্সের (আইআইএসসি) রাসায়নিক বিজ্ঞানের এই অধ্যাপক।

বিশ্বেদারক হিসেবে পিকারিক অ্যাসিডের মতো রাসায়নিক ব্যবহার করা হয়। পার্সারথি বাবুর তৈরি করা ক্ষুদ্রাণু ক্ষুদ্র কণাগুলি পিকারিক অ্যাসিড মিশ্রিত বিশ্বেদারকের ক্ষেত্রে 'সেন্সর' হিসেবে কাজ করবে। তবে শুধু বিশ্বেদারক সন্ধানেই পার্সারথি বাবুর এই গবেষণা ঘেঁষে থাকেনি। তাঁর সহযোগীরা জ্ঞানান, শরীরের মধ্যে নির্দিষ্ট কোষে ওষুধ পৌঁছে দিতে বা রোগাক্রান্ত কোষের ছবি তুলতেও এই যুগে কণা কাজে লাগবে। অর্থাৎ বাটার মতো এই ক্ষুদ্রকণাগুলি রাসায়নিককে পৌঁছে দিতে যানের কাজ করবে।

শান্তিধরপুর ভাটনগর পুরস্কার গবেষণায় দেশের সেরা বীজকৃতি হিসেবে পরিচিত। কিন্তু বছর ১১ জন বিজ্ঞানী সেই পুরস্কার পান। এ বার রসায়নে পার্সারথি বাবুর পাশাপাশি জীববিজ্ঞান কলকাতার ইন্ডিয়ান ইনস্টিটিউট অব কেমিক্যাল বায়োলজির বিজ্ঞানী শুভেন্দ্রনাথ ভট্টাচার্যও এই পুরস্কার পেয়েছেন। পুরস্কার পাওয়ার পরে পার্সারথি বাবুর প্রতিক্রিয়া, "পুরস্কার বা বীজকৃতির পোডো কাজ করি না। তবে শান্তিধরপুর ভাটনগর পুরস্কার পাওয়া সত্যিই আনন্দের।"

বাবু বাবু-গুরু গ্রামের বাড়িতে এখনও পার্সারথি বাবুর বাবা-মা থাকেন। গ্রামের ছেলের এমন

পার্সারথি বাবু আন বাবা-মা থাকেন। গ্রামের ছেলের এমন

পার্সারথি বাবু আন বাবা-মা থাকেন। গ্রামের ছেলের এমন

পার্সারথি বাবু আন বাবা-মা থাকেন। গ্রামের ছেলের এমন

পার্সারথি বাবু আন বাবা-মা থাকেন। গ্রামের ছেলের এমন

পার্সারথি বাবু আন বাবা-মা থাকেন। গ্রামের ছেলের এমন

পার্সারথি বাবু আন বাবা-মা থাকেন। গ্রামের ছেলের এমন

পার্সারথি বাবু আন বাবা-মা থাকেন। গ্রামের ছেলের এমন

পার্সারথি বাবু আন বাবা-মা থাকেন। গ্রামের ছেলের এমন

পার্সারথি বাবু আন বাবা-মা থাকেন। গ্রামের ছেলের এমন

পার্সারথি বাবু আন বাবা-মা থাকেন। গ্রামের ছেলের এমন

পার্সারথি বাবু আন বাবা-মা থাকেন। গ্রামের ছেলের এমন

পার্সারথি বাবু আন বাবা-মা থাকেন। গ্রামের ছেলের এমন

পার্সারথি বাবু আন বাবা-মা থাকেন। গ্রামের ছেলের এমন

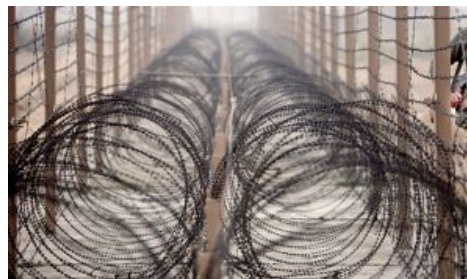
পার্সারথি বাবু আন বাবা-মা থাকেন। গ্রামের ছেলের এমন

পার্সারথি বাবু আন বাবা-মা থাকেন। গ্রামের ছেলের এমন

পার্সারথি বাবু আন বাবা-মা থাকেন। গ্রামের ছেলের এমন

পার্সারথি বাবু আন বাবা-মা থাকেন। গ্রামের ছেলের এমন





Borders in Science and between Nations:

The need for them and the need to have a healthy disrespect for them

- Prof. E. Arunan

Tamil is an ancient language that has been around for several millennia. Several philosophers have written poetry, which are very old, but their content remains applicable for all the times. One such poem was written by Kaniyan Poongundranaar during the Tamil Sangam (perhaps comparable to the Academic Societies today) period, which started around 300 BC.⁽¹⁾ This poem starts: யாதும் ஊரே யாவரும் கேளிர் (Yaadhum Oorae, yaavarum kaelir), loosely translated as "All towns are the same and all people are our kin". This is depicted in the United Nations Organization for the profound truth it conveys.⁽²⁾ The translation given in the Wikipedia page quoted says 'all men are our kin'. This is incorrect and 'all are our kin' is the right translation. The poet did not envision any borders between towns!

I have been in the editorial advisory board of Physical Chemistry Chemical Physics (PCCP), a journal published by the Owner societies. The title of the journal implies that the border between physics and chemistry is thin and either can be the first or last name for the sub-discipline. More importantly, this journal showed how borders between the nation-states of Europe had become thin. This Journal combined several favorite Journals in physical chemistry published in various nations in the UK and Europe (among them were two journals named after two of the greatest scientists of all time, Faraday and Bunsen, Faraday Discussion, published in UK, and 'Berichte der Bunsengesellschaft für physikalische Chemie' published in German). PCCP has established itself as one of the leading Journals in this area. Brexit may have happened but I am confident that PCCP will continue, at least, for my lifetime. It is published by the Owner Societies, which has many of the European Chemical Societies as its members. A few years ago, Chemistry, an Asian journal came into existence as well.

When I was in high school in the 1970s, I remember learning that chemistry is the study of matter and that physics is the study of energy. Of course, Einstein's famous equation $E = mc^2$ was already known, having energy on the left hand side and matter (its mass) on the right hand side. One can translate this equation as physics = chemistry. However, physics and chemistry still exist as individual and independent disciplines, and they may continue to exist. One subtle difference that would be lost in this generalization is that chemists worry more about how atoms combine to form molecules or liquids or solids. They worry about the interactions between them and how they transform from

one to another. The study of making and breaking bonds between atoms is indeed chemistry. Though atomic physics exists, there is no atomic chemistry. Atoms have to join together for chemistry!

Science, as a pursuit of understanding nature, really cannot have a border. However, it is important to have disciplines and sub-disciplines, and sub-sub-disciplines and for individual researchers, focus on one specific problem in a narrow sub-discipline is needed. Divide and conquer works.

One soon realizes that even to solve a specific problem in science, it is important to have contributions from many disciplines. Again, taking a personal example, we have established experimental laboratories in India, where we can make the weakest bond, even between inert gases such as argon and neon, and study them with a pulsed nozzle Fourier transform microwave spectrometer. We can also break the strongest bond, the triple bond between two N atoms in N_2 , in a single pulse shock tube. In both laboratories, building the experimental facilities involved knowledge of mechanical engineering, electronics and communication engineering, vacuum techniques, physics, chemistry and, of course, mathematics. One lifetime is not enough to learn all these thoroughly but even to talk to experts in all these areas one needs to understand these subjects to some extent. It is important to collaborate, and that involves mutual trust and respect. Learning all these subjects is not trivial and may require different skills one person may not be able to acquire. None of these skills are more important than others.

We have had humans on this earth for 200,000 years or more. Currently, we have more than 7 billion people on our earth and they are distributed in about 250+ countries. We started living in caves, feeling secure and hunting animals, migrated to plains, started farming, developed languages to communicate with each other and started developing codes of conduct so that we can all coexist. We really had no choice about whether to exist, but having come in to this world, we

had to find ways to coexist. Religion was found and religious texts prescribed rules for life. Eventually, over the last few hundred years, the nation-state model has started working well. Most nations are democratic and they have a constitution to guide them with elected representatives who have a fixed term.

Given the size of this world, it is not practical to be governed by one ruler or executive and so we have many countries, which are divided into states, which are divided into districts, and so on. And we have the United Nations. Any conflict in smaller entities is resolved by discussion and arbitration, with mutually agreed rules. While these borders are needed for practical purposes, as the borders in science, we need to realize that these are arbitrary and came in to existence rather recently. As much as a chemist has no reason to hate a physicist, I don't see any reason for a person from one district or state or country to hate another one from a different district or state or country. One could add language and religion as well, which are drawing borders between people. As it is true in the border areas of science,

one can note that in the borders drawn based on language, religion, state, nations etc., there is really no big difference between the two sides.

Those from India were worried about two things as a nation in recent times. Tension in the borders between India and Pakistan and the tension in the borders between the states of Tamil Nadu and Karnataka. When we realize that the senior leader of the ruling party BJP, Advani was born in what is Pakistan today, one can get a different perspective. Hosur, a small town in Tamil Nadu, bordering Karnataka, has its name in Kannada (Hosur in Kannada means new town). I have been to temples 60 km north of Bangalore (Yoga-

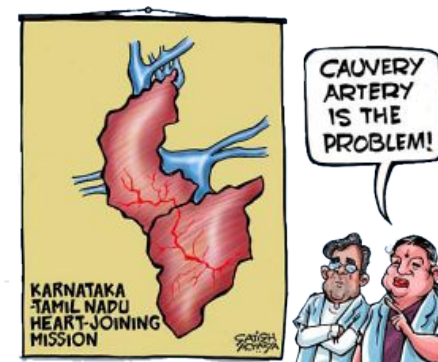
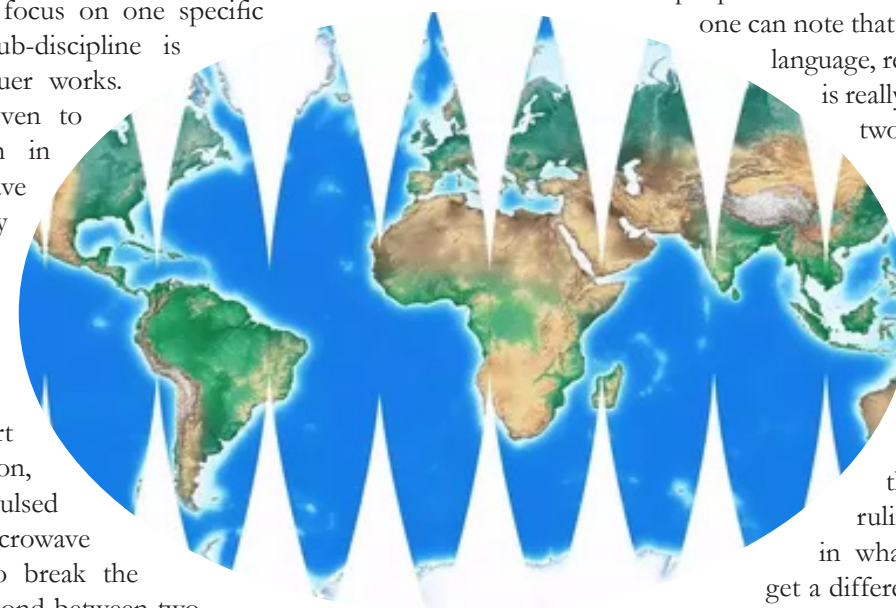
narasimha temple), where I saw the statues of 13 Aalwargal (Vaishnavite saints, following Vishnu as their God) who wrote poems in Tamil. Clearly the borders have been drawn recently. If we use them for any reason other than administrative simplicity, we will have problems.

Scientists know the importance of collaboration. Again, taking an example from a field that has excited me, i.e. the hydrogen bond, one of the most important papers was published recently in Science, from China through a collaboration between physicists and chemists.⁽³⁾ They could see 'the hydrogen bond', when not so long ago seeing atoms and molecules was thought to be impossible! Anyone interested in learning more about this can read a commentary I wrote in Current Science, which is available online with free access.⁽⁴⁾ Naturally, when people from across the borders work together, they can achieve lot more than what is possible when they work independently. However, not only in science, but also in human relations, mutual trust and respect are important. When that is lost, there will be tension, war, destruction. Sooner or later, people realize that it is better to develop mutual trust and respect and find ways to coexist.

I recommend an autobiography written by Prof. Curt Wittig from the University of Southern California.⁽⁵⁾ It is long but worth reading. A part of this was published in the journal of Physical Chemistry A in a Festschrift in his honor a few years ago. He has done some beautiful experiments in physical chemistry that helped in understanding the microscopic details of how chemical reactions happen. From his autobiography, one can learn a few things about the nations and their borders in Europe. The city in which he was born kept changing hands to different countries. His experiences in the Chicago southern neighborhood are unbelievable. It also shows that where you started in life hardly matters. Given the right opportunities, you can excel in your career and life.


In closing, let me reiterate: One should not take any of the borders too seriously, if one is interested in real progress. In the references below, two are to Wikipedia pages and they have to be understood as unauthenticated information.

1. https://en.wikipedia.org/wiki/Sangam_period Accessed on 20 September 2016.
2. https://en.wikipedia.org/wiki/Kaniyan_Pungundranar Accessed on 20 September 2016.
3. J. Zhang, P. Chen, B. Yuan, W. Ji, Z. Cheng, X. Qiu, Science, Vol. 342, Issue 6158, pp. 611-614 2013. Link: <http://science.sciencemag.org/content/342/6158/611>
4. E. Arunan, Curr. Sci. VOL. 105, NO. 7, pp 892-894. Link: <http://www.currentscience.ac.in/Volumes/105/07/0892.pdf>
5. C. Wittig autobiography, longer version available at <http://www.curtwittig.com/wp-content/uploads/curt-wittig-autobio.pdf>



Special Seminars

Name of the speaker	Affiliation	Topic	Date
Dr. R. K. Hanson	Department of Mechanical Engineering, Stanford University, USA	Shock tube and laser sensor research at Stanford.	05/12/2016
Prof. Martin Gruebele	Beckman Institute, University of Illinois at Urbana-Champaign, USA	How does a glass surface flow.	16/12/2016
Dr. Pallavi Bhattacharya	Department of Chemistry and Chemical Biology, Cornell University, USA	Energy transport, spectroscopy and diffusion.	23/12/2016
Dr. Sudhakar Varanasi	Chief Mentor, IISE/Emergent Institute, Bengaluru, India	Working with head and heart aligned: My experiences with setting up 108 emergency services in India.	02/01/2017
Prof. Nils Metzler-Nolte	Ruhr University, Bochum, Germany	Metal-based antibiotic drug candidates: New structures and studies towards their mode of action.	05/01/2016
Prof. Mohan Srinivasarao	School of Chemistry and Biochemistry, Georgia Institute of Technology, USA	Differential dynamic microscopy.	06/01/2016
Prof. John R. Reynolds	Georgia Tech Polymer Network, Georgia Institute of Technology, USA	Conjugated polymers in active devices: Photovoltaics, electrochromism and charge storage as case studies.	06/01/2016
Prof. Nicholas Spencer	Department of Materials, ETH, Zurich, Switzerland	Pushing and sliding on brushes and gels	12/01/2017
Prof. Nikos Hadjichristidis	Physical Science and Engineering Division, King Abdullah University of Science and Technology, Saudi Arabia	Anionic polymerization: From high vacuum apparatuses to industrial applications	13/01/2017



Prof. Alan S. Goldman	Department of Chemistry and Chemical Biology, Rutgers University, New Brunswick, USA	Dehydrogenation and related reactions of alkanes catalyzed by iridium complexes: mechanism, selectivity, and a new class of catalysts.	18/01/2017
Prof. Elliot Bernstein	Department of Chemistry, Colorado State University, USA	EUV laser photoelectron spectroscopy of mass selected neutral clusters and molecules.	06/02/2017
Prof. Richard N. Zare	Department of Chemistry, Stanford University, USA	Human alcoholysis: How fast and how long does alcohol consumption affect human behavior.	11/02/2017
Dr. Murthy S. Gudipati	NASA Jet Propulsion Laboratory, California Institute of Technology, USA	Astrophysics, astrochemistry and astrobiology: Exploring the universe in search of life beyond earth.	15/03/2017
Prof. Henry F. Schaefer III	Center for Computational Quantum Chemistry, University of Georgia, USA	Quantum chemistry and large scale computations: A tightly connected parallel development.	21/03/2017
Prof. Jas Pal Badyal	Department of Chemistry, Durham University, UK	Functional surfaces	23/03/2017
Prof. Martin Albrecht	Department of Chemistry and Biochemistry, University of Bern, Switzerland	Less stabilized carbenes: Efficient ligands for exciting catalysis.	28/03/2017
Prof. S. P. Rath	Department of Chemistry, Indian Institute of Technology, Kanpur, India	Diheme enzyme MauG: Nature's sniper for long range electron transfer.	13/06/2017
Dr. Sadagopan Krishnan	Department of Chemistry, Oklahoma State University, Stillwater, USA	Biosensors and microarrays for disease markers.	16/06/2017

THUMBA DHANYAVADAGALU, NARYANAPPA AND CHINAPPA!

A Fond Farewell to Two Pillars of the Department

In conversations with Mr. Narayanappa and Mr. Chinappa ahead of their retirement from the Institute on July 31, Srividya Kumar learnt these interesting facts about our two devoted staff members.

Mr. H. B. Narayanappa hails from the village of Hanumanthapura near Nelamangala. This village is a part of Bangalore Rural district. He successfully completed his Secondary School in Makana Kuppe Municipal High School, Nelamangala. During his school days his favorite pastime was reading books and playing badminton and caroms. Later, he earned his Pre-University degree from Sheshadripuram Evening College, Bangalore. Asked about his coming to the Institute, he recalls the exact day he entered its service – June 16, 1977. His first job here was in the Maintenance Department, and after three years in that position, he joined the IPC family on January 12, 1980. Recalling that occasion, he immediately pulled out a file to show me the date of his joining. Since then, he has spent close to 38 years in devoted service to the department's myriad administrative needs. His duties here included maintaining records of all official papers entering and leaving the department, managing and organizing files, and handling all official telephone calls. He had these parting words to say to IPCians: "Thanks to all. I feel very fortunate to have served this department, and to have interacted with the faculty and students." After his retirement, he plans to spend his time with his wife Mrs. Jayalakshmi Amma in his native place, or with his children's family in Bangalore.

Mr. D. Chinnapparaj is part of the Institute's multi-task staff. He has a number of responsibilities in the department,

but he is perhaps best known as the person who identifies which students have not returned instrument room keys to the office by 9 am. He also ensures that various common rooms in the department, including instrument rooms, lecture halls, class rooms, and committee rooms, are opened at the right time in the morning and locked and secured at the end of the day. Even more importantly, he makes sure we have enough coffee and tea before the start of seminars and colloquia to keep us awake! Mr. Chinapparaj was born in Tiruvannamalai, now a city in the state of Tamil Nadu. After completing the 8th grade in the city's Government Elementary School, he moved to Bangalore, where he completed the 12th grade in St. Xavier's Boys High School, Shivajinagar. He has cleared junior and senior exams in type-writing, and has also received training in short-hand writing. He joined the Department of Microbiology and Cell Biology as a lab attender in 1976. After 10 years of service there, he secured a permanent employee position in our department, for which he is very grateful to the Institute. He has served our department for 31 years. He loves to visit Velankani Church during Christmas time. He plans to spend his retirement life with his wife Mrs. Clara Lily and his three children. This is his farewell message to the department: "Thanks to all. Thanks for having friendly relations with me."

We wish these two dedicated IPCians and their families a future full of health, happiness and prosperity.



A New Member of the Department

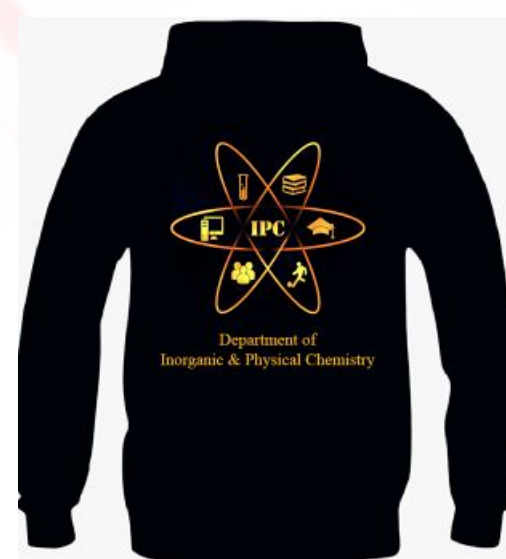


Hello and Welcome !

Meet **Dr. Chinmoy Ranjan**,
our newest faculty member, who joined
IPC Department on July 18, 2017.



Life
@
IPC





Department of Inorganic and Physical Chemistry
Indian Institute of Science, Bangalore-560012