

*Opinion***Should Rolling Stones Worry About Gathering Moss?**

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The Latin version of the proverb “A rolling stone gathers no moss” is included by Erasmus in the third volume of his collection of Latin proverbs, *Adagia*, in 1508. Mosses grow slowly and moving the stone on which they are growing inhibits their growth. The proverb has come to mean that for prospering, one should settle down. Does it mean that scientific productivity requires one to restrict himself/herself to a particular area?

A few decades back, I was talking with a much younger but more visible colleague from a national laboratory. It was one of those “after the meeting evening informal chats” in the guest house. Suddenly, this person announced that I would have been able to contribute more to science if I had focused more on a specific area. I figured that he actually meant being visible rather than contributing to science. Honestly, I think Pauling contributed to science, Feynman contributed to science. I do not think I would have been able to “contribute” even if I had “focused” more on the specific areas. Speaking of Pauling, there is a delightful book (Rich and Davidson, 1998) which came out when he turned 60. The book is a compilation of articles by his former associates who had worked with him over the years. It contains and describes areas as diverse as structure of minerals to molecular theory of anaesthesia!

In my own case, I was trained during my Ph.D. for working in the area of what was called “chemical modification of proteins”. When I joined the faculty of IIT Delhi, I soon figured out that I will not be able to acquire the necessary facilities for that kind of work. One day, my first graduate student told me that

he is unable to elute his enzyme from an ion-exchanger. I had vaguely heard of enzyme immobilization. I figured that we had inadvertently immobilized the enzyme. That led to my laboratory publishing the first of several papers on enzyme immobilization. It happened because we were not averse to moving out of our comfort zone. We did not wander very far. In reality, we just started using enzymes as heterogeneous catalysts rather than homogeneous catalysts! Later, when we were using smart polymers, it occurred to us that we could immobilize enzymes on such supports and still use them as homogeneous catalysts (Gupta and Mukherjee, 2015). It is however interesting how one thing leads to another. Years later, we found these smart polymers to be useful for refolding proteins (Gupta and Mukherjee, 2015).

Suddenly we, as a group, found ourselves working in the broad domain of biotechnology. That is known to be a multidisciplinary area. When one strays away from what one is doing, one needs to learn new tools and new skills.

Why is there so much hypocrisy among “visible scientists” in India? I grew up listening to our leaders in science that we must encourage multidisciplinary efforts in science. Yet, I often found tunnel vision among some of these (thankfully, not all) people when they sat on committees. Once upon a time, I ran a collaborative project with another (now well known) scientist from what was called UDCT at that time. It was funded by the chemical engineering task force of DST. We published enough joint as well as individual papers in the area of bio-separation. After

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that, I submitted a project to that task force. The task force had some eminent people from NCL, BARC, IIT system, etc. They had no problem with the project but their main objection was that I am not a chemical engineer! They were not prepared to fund a biochemist to work on a biochemical engineering project. Biochemical engineering combines skills of biochemistry with those of chemical engineering. I thought they will encourage the multidisciplinary effort (or bi-disciplinary, if you would like to call it that!).

These chemical engineers obviously lacked the wisdom of Neil Winterton (Winterton, 2011). A shorter version of what he said in the book is available as an overview (Winterton, 2012) so appropriately titled “Chemists and chemical engineers: divided by a common discipline”. Whereas we chemists talk of reactions/reaction schemes, chemical engineers talk of reactors/processes. Our stoichiometry is their mass balance! Ironically, shortly thereafter, I was approached by the concerned DST officer to evaluate a project submitted in the area of biochemical engineering and which was to be dealt with by the same task force.

For the first time in my life, I refused to help out with a comment – the potential PIs have dreams; the task force should have vision. In the absence of the latter, in the case of this task force, I see no point in wasting my time. That was a pity as the concerned officer was one of the better ones among those with whom I have dealt with in those corridors of power. The idea in narrating this is not to brush off on an old pique for airing. The point is that such mental ghettos continue to exist among our “creamy layer” of Indian scientists.

I think (going by the current grading system at IIT, Delhi) that the funding agencies should get at least B+ grade. In India, we are all victims of the system in which we work. May be, I should have expected the above response by the task force as I had chosen to work in a multidisciplinary area. To the people wearing blinkers of specialization, that kind of proposal appears as neither fish nor fowl.

I am not sure what the remedy is? By and far, most of such committees consist of some very good scientists; who are very wise people as well. They

also, unfortunately, often end up having some people who talk more and read less. In a democracy, one who talks more and/or more loudly prevails. One way to promote multidisciplinary efforts is to include people who read more widely. They may not belong to well-known “gharanas” of Indian science but normally a well-read person is not a nuisance-maker. Unfortunately, we also tend to confuse that with having convictions!

I have referred elsewhere of the dangers of diverting a major component of our funding to the so-called thrust/thrusted areas (Gupta, 2012). More often, true innovation will start a new area. Let us gamble at least in a small way on whacky ideas. At times, we give away crores without much analysis and debate endlessly on a 20 lakh project.

The scientists working in projects which straddle more than one area also have a problem of publishing. While journals with very high impact factors like the Journal of American Chemical Society, Science or Nature will publish such work, lesser efforts do not have very many target journals available. To me, that looks like an opportunity for Indian journals. If we are able to push their impact factor to even around 2 and encourage papers/reviews with a multidisciplinary angle, we may kill two birds with a single stone. In this context, an editorial in this journal needs more attention from our leading scientists in general and the academy fellows in particular (Lakhotia, 2012).

Having talked mostly of the ‘pain’ part, let me talk of the ‘pleasure’ component. In my own case, meandering was a necessity. I have described earlier what all areas we visited during the apparently aimless journey (Gupta and Mukherjee, 2015). The good part was we never felt bored with what we were doing. A lot of cross-fertilization of ideas was possible within the group. There was always something new to read; something new to learn. It also kept the group free from the attack of hubris; we all were just beginners all the time.

Who wants moss? To be “on the move” feels good. I think we should encourage our younger people to occasionally try moving out of their comfort zone. Afterall, curiosity and adventure are siblings!

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