- Just by contemplation and by virtue of his social status, Aristotle (384-322 BC) propounded the theory that the Earth was at the centre of the Universe, the Sun and all other planets moved around it and everyone accepted this. It was common sense that the solid Earth could not be moving. Copernicus came along in the sixteenth century and tentatively suggested the reverse, i.e. that the Sun was at the centre and that the Earth and other planets revolved around it. But Copernicus, too, did not arrive at this conclusion through observation. He did so by thinking. Students' and teachers' take off points from the above: Then, in the latter half of the sixteenth century, even when Galileo had proof with his telescope that Copernicus was right, why did he meet with opposition and imprisonment? What are the cherished beliefs we hold onto, that we hate to let go of, even in the face of sufficient evidence to the contrary?
- Van Leeuwenhoek's discovery of tiny moving creatures in droplets of water: until then, people assumed that water drops did not have any living things in them. Students' and teachers' take off points from the above: Like this, what are the assumptions we make about things around us? How can we prove them wrong/right?

With examples like the above serving as a launch pad, the teacher can move on to exciting classroom processes, which will undoubtedly provide rich learning experiences for both the teacher as well as the taught.

It is said that while testing the right material for the filament of the bulb, Thomas Edison had to try thousands of different filaments to select the right materials to glow well and be long-lasting. Eventually, he hit upon the right one. When asked by a news reporter how it felt to fail thousands of times before he finally succeeded, he replied: "I did not fail even once! My experiment simply had thousands of steps."

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WHY I CHOSE SCIENCE?

A Quest for Understanding

Usha Ponnappan

When I tried to introspect as to why I chose Science as a career path, it was truly the very first time that I had delved into my past as a student, trying to search through my memory bank for that one special moment in my life that was a turning point. However, while it became clear that no one specific event set the stage for my future in science, it was, I think, a series of unrelated events that shaped my thinking that ultimately led me down this adventurous path, that I so cherish today.

Unlike writing a scientific manuscript, where one outlines the experimental design and a series of results that are leading to outcomes, this exercise of writing about my choice of Science as a career, largely relies on my memory and perhaps on some anecdotes of events in my early life. I cannot state with certainty whether it was my flair for life sciences or if it was the influence of my mentors along the way, that made it second nature to me, but I always gravitated and did well in biology.

The turning point, if I could call it that, was when I received the National Science Talent scholarship at the completion of high school. This merit scholarship provided by the Government of India fostered building future scientists on the path of basic science. One

important facet of the National Science Talent scholarship examination that remains etched in my mind is my choice of a project report that I submitted for the scholarship application. It was in an area of cellular communication in the nervous system. Incidentally, while communication in the nervous system and action potentials still peak my interest, my major focus now centers on how cells communicate in the immune system. Looking back at my career and my choice, I would say that being awarded the science talent scholarship opened doors that would not have been easily accessible otherwise.

Science talent scholarships, provided by the Government of India (NCERT), are structured to select those students with a talent and aptitude for basic science, and encourage them to develop as the next generation of scientists. I truly believe that this opportunity afforded to me provided a strong impetus and encouragement to pursue my ambitions. It is initiatives such as this that will help fulfill our ambitious goal of promoting science and in making our younger generation competitive in this global economy. Additionally, the NCERT scholarship was tailored to provide research intensive training during the summers of undergraduate and masters programs, to mould and train young minds towards research inquiry. I feel that, at least in my case, the program was a success. Since I had the aptitude for research, the encouragement and opportunities provided were tailor-made. The scholarship, needless to say, helped me in my choice of institution for my graduate studies and in selecting a well-recognized scientist as my mentor. This was a gift, considering that most of my colleagues had to pick what was available rather than have the luxury of picking laboratories of their choice.

Now, to the larger question: Why did I become a scientist? The grandeur of solving questions is in itself sufficient motivation. However, I felt that one of the best things about being a scientist is the pursuit of understanding the workings of a paradigm, be it in biology or medicine. Added to this, is the ability to translate the understanding into effective therapies for the improvement of the health of an individual. A quest for understanding is ultimately what drove me to where I am today - the challenge, opportunities for innovation and problem solving that science provides. As a scientist, one can continue to ask questions with a child-like curiosity.

> *"There are two possible outcomes. If the result confirms the hypothesis, then you've made a discovery. If the result is contrary to the hypothesis, then you've made a discovery."*
>
> *- Enrico Fermi*

During the days of my graduation, my goal was to work on mechanisms and translational initiatives in the newly-developing field of reproductive immunology, with the intent of developing vaccines for contraception. This was driven by the desire to aid in the growing need for population control in India. Soon, as a budding graduate student, I realized that though my goals were lofty, the pursuit of those were challenging at the bench. Nevertheless, I look back on my graduate education at the Institute for Research in Reproduction, an ICMR institution in Parel, Bombay, with fond memories. This is the place where I learnt the essence of scientific inquiry and the reality of how every experiment, whether it produced expected results or not, eventually taught us something. It was here that I honed the skills of inquiry, scientific presentation and communication.

My recollections and experiences of how science is taught in schools and how it could be different, is something that I have dwelled on, for a long time now, since I have been intimately involved in teaching at the graduate level and in the medical school, here at the University. As a teacher, I derive the greatest pleasure when I teach by questioning, rather than by merely telling or stating facts. I find that my students learn the most when they are interactive, such as designing experiments or framing apt questions for testing a model. However, if my recollections are correct, science was often taught in our schools as direct transfer of information with the hope that students would rote memorize and recall the information in

tests designed to precisely examine this method of gaining knowledge. Little, if any, emphasis was placed on the idea of conceptual knowledge and gaining of insight into an area, by questions designed to test the hypothesis. While questioning was encouraged, and was often directed at the students, interactive question-answer sessions were largely restricted to review sessions, which were too few to recount. I personally think that hands-on experience that we had in our high school curriculum, doing experiments in laboratories, be it chemistry, physics or biology, perhaps laid the ground work for the development of technical and problem-solving skills. More time devoted to such concrete methods of hands-on experiments, to see how science works, will clearly help develop a cadre of young individuals more driven to science. Now that we live in an information-rich society and with the availability of excellent text books/other resource books, students should be advised to read the material before they come to class, and classroom teaching should be devoted to discussions and intellectual interactions. Time should be provided to assimilate concepts, and insights should be provided in areas of focus, such that the time in the classroom is utilized to assimilate knowledge and think.

I truly believe that such a re-focus of classrooms will revolutionize teaching and empower our students to be life-long learners and enthusiastic problem-solvers. This clearly means that we, as a nation, have to invest in teachers - teachers who are highly skilled - for they alone can be beacons, leading our nation's young into a bright and challenging future, with an inherent quest for understanding.

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"Why is it, sphinx, that the barks of trees
Can't have just any colour they please,
Brown in colour, all look quite the same,
But trees differ in flower, fruit and name?"

Barks In Uniform

Nature has used her paintbrush to splash colours over flowers, fruits, birds and animals, but she seems to have run out of ideas when it comes to barks of trees. All of them are brown, perhaps varying only in the particular shade.

Why is this so? Nature must surely be very wise with a purpose behind the creation of coloured petals in flowers. If flowers were not so attractive, bees and butterflies would not go to them so easily to suck their nectar and cause pollination. Without pollination,how would flowers reproduces? It is their beautiful appearance that draws these flighty messengers to flowers and ensures the survival of their species. Barks of trees, on the other hand, do not have any such function. Their role is to act as a firm support for the tree without any need to look attractive. What is important is their hardness, toughness, height and width, rather than their colour. So nature has concentrated on these aspects of the bark of a tree by making it a firm and solid support.

Further, the main chemical compounds present in the bank of a tree, called tannins, are brown in colour. They lend the uniform colour to the tree's bark, the particular shade varying owing to different amount of tannin present in different trees. This is the reason why the barks of all trees are brown in colour.

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