“Who wants to be an innovator like Edison?”

The voice of my high school science teacher triggered many hands of her pupils to go up. With hesitation, I too joined. “Good, great spirit! But, one needs to be as enterprising as Edison to accomplish similar feats,” she continued.

With only average scores in examinations, my hopes of coming up with an innovation ever, even by my own liberal judgments, were nothing more than a fantasy. “It is not our cup of tea,” said my buddies.

For me, physics had been a daunting subject, and a tough nut to crack. Unsuccessful endeavours in science fairs did not help me either. “How could the great exponents of science and innovation turn thoughts into discoveries and inventions?” I often wondered. Necessity, by tempting one to think out-of-the-box, I learned as time rolled by.

In the early 1990s, India had been witnessing a surge in sectors of biotechnology – the world of microscopic bacteria and gene technologies – and information technology. Gene synthesis and termination, cloning, gene therapy, and DNA-based criminal investigations soon started finding space on the front page of newspapers. I was much fascinated by rapid scientific and technological advancements in biotechnology. With a biology background, I felt, perhaps, I could find a foothold in this challenging research field.

I didn’t have to wait too long to start my research career. With the completion of post graduation in biotechnology, in 1996, I had joined an agriculture research institute in Bengaluru. My research pursuit began with testing chemicals, purified from soil bacteria, against tiny, plant root parasitic worms – the nematodes.

While earthworms are a boon, by inflicting crop loss and low yield, these root infecting worms have been a bane to agriculture. With no cheap chemical formulation available, farmers had to rely on not so robust neem tree products to control this plant parasite. Given the nature of this parasite, and inherent limitations of testing, discovering an eco-friendly, yet potent plant anti-worm was very challenging.

I remember picking worm’s eggs from infected plant roots, and hatching them, before testing chemicals for its lethal effect under a microscope had been painstakingly tedious and laborious. Notwithstanding, the survival of the hatched worms was quite unpredictable.

Faced with experimental blockades, I sought for laboratory-grown worms – largely used in developmental biology research – from a Japanese University. It was rather easy to rear and maintain them in a small laboratory dish.

This tiny creature was as small as less than one millimetre long, and visible clearly only under the microscope. And it was an amazing experience to watch them crawling relentlessly, at a frantic speed, covering the length and breadth of the dish in a few seconds. In fact, it made ridiculously simple to understand the extent of the killing effect of test chemicals by merely observing the moving pattern of the worm. Endorsing unorthodox research strategies, I imparted momentum to the experiments, which until then had progressed at a snail’s pace; I had sensed a research innovation for the very first time.

By the end of 1998, I left for a permanent job, at one of India’s premier biotechnology research institute in Pune. Engaged in cutting-edge research on modern biology, it was also a designated body to supply cells – the basic building block of all living beings, to other research units across India.

With the visit of the then human resource development minister of India to our institute, in 1999 my research routine took an unprecedented turn. He was concerned about the patent claims by non-resident Indians and foreigners, over traditional medicines – especially turmeric and neem.

In the early 2000s, while experiencing the fruits of economic liberalisation, India had been feeling its negative side too. Uneasy changes in lifestyle had brought up diabetes as a gripping uninvited guest to all strata of the society. The high cost and complementary side effects of allopathic medicines for diabetes compelled advanced research, and development of relatively cheap natural medicines, hoping that it would open a door for the western market too.

Soon, I was assigned to initiate and continue research on fenugreek plant, for its use in diabetes care. But then,
consumption of fenugreek seeds or leaves had been a customary practice to get relief from rising blood sugar and fat. What could I do special to innovate and claim a patent over it? I was clueless.

After an initial hiccup, I sought to work on the limitation of fenugreek consumption in controlling diabetes. Bitter taste and intestinal discomfort at times made its direct use relatively unpleasant. Also, fundamental and scientific logic for its use in diabetes was rather a mystery. What took me by surprise was the great demand for improved fenugreek products, despite all these anomalies.

It took almost two years of intense research before I could come up with an altogether new decoction of fenugreek seeds. Rigorous testing was followed in laboratory mice. The pausing time of glucometer, before displaying the blood sugar level, used to give me draining nervous moments. And then a sense of satisfaction soon hit me – my research endeavour had proven a rationale for the use of fenugreek in diabetes.

In the docks of scientific scrutiny, it was still left to be explained how the new decoction works on the body, to contain the rise in blood sugar. Experiments on cells – the powerful tool in biomedical research to decode the scientific features of a disease – and biological circuits, became inevitable.

To define a strategy for cell testing, I had to get to the bottom of the science of diabetes. In fact, a spike in our blood sugar is bound to happen following a meal. To counter this surge, sugar is then pulled inside the cells of the body to generate energy through the mobility of a certain sugar carrier. These carriers are known to rest inside the cell, and only the hormone insulin or biochemical changes in the aftermath of exercise can force their movement to the boundary of the cell to take sugar that brings normalcy in blood sugar.

From the scientific perspective, I did not have a thought other than pinpointing the mobility of the sugar carrier, to predict the glucose lowering feature of a test entity. That was an unprecedented move in the realm of diabetes research, on those days.

But, on the other hand, cells for diabetes-related experiments were few and far between. Notwithstanding, visualising the instant movements – otherwise called live imaging – of the sugar carriers was next to impossible with the cells and microscopic imaging technologies within our reach.

No wonder, I felt the call for an out-of-the-box approach – marking and tracing of the movement of glucose carrier – in my research programme. By then, researchers in western laboratories had already made a fusion gene of this carrier, and a fluorescent signal – a biological marker that revolutionised biomedical research, in tracing anything inside the cell. In a few months time, I managed to get hold of this fusion gene from an American laboratory.

Having already been trained in the latest gene transfer technology, it did not take long before I could successfully introduce this gene into a cell. Amazing high magnification visuals of fluorescent carriers of sugar inside the cell caught me awestruck.

I focused on the gruelling cell testing experiments. The realisation that I could be one of those few privileged to have ever watched the motion of the carrier, to drag sugar into the cell in response to insulin – the actions that happen in the cells of our body following a meal – thrilled me. I knew, a hitherto unknown new cell type for diabetes research had been born.

The new prototype of cell became a benchmark to predict anti-diabetic features of new chemicals and formulations. Soon, scientific studies on fenugreek decoction were completed successfully in this new cell type. The new findings occupied the pages of prestigious scientific journals of the Nature publishing group. It was a defining moment in my life when scientific features of this cell and fenugreek decoction were telecast on the DD National channel as a documentary, titled Wise Spice.

Meanwhile, patents were granted for the invention of new fenugreek products. While grabbing experimental challenges as opportunities, the innovation came naturally on my way to meet the research objective.

But, then, scientific advancement is a relentless process. My achievements were mere small steps towards achieving greater end points. My mission to realise a pharmaceutical dream – an alternative to insulin for a better diabetes treatment, is still on. When I look back, my journey from the nook of a hamlet to the corridors of biomedical innovation has been nothing less than a fairytale.