The pleasure of learning

How an Italian visitor rekindled the joy of science in a war veteran.

Leon Lederman

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Keeping in touch: Leon Lederman urges us to rediscover the day-to-day enjoyment of science.

Picking up the threads of normal life after a war is difficult, even when you are on the winning side. In 1946, returning from the Second World War, I registered at Columbia University, New York, as a graduate student in physics. That ensuing year was the worst that I can recall. The classes were crowded with veterans returning from military service or from research in the various laboratories that had supported the war.

The teaching faculty was also just beginning to return, and so most of the courses were taught by Isidor Isaac Rabi (the chairman of the physics department, and winner of the Nobel prize for physics, 1944) and Willis Lamb, who was also to win a Nobel prize in 1955. Rabi exuded charisma and enthusiasm, but his lectures were confused and often incoherent. By contrast, Lamb's lectures were well organized and clear, but delivered in such a soft, droning voice that they tended to induce sleep. For years after we became colleagues, I would yawn compulsively on meeting Lamb. In time, I came to appreciate the depth and brilliance of Lamb's intelligence, but for a new graduate student who had not opened a book in more than three years, the effect was discouraging. I began to question my decision to switch from chemistry to physics.

About midway through my second year, I applied for a research position. Columbia was building a particle accelerator and they would need instruments and people who could be involved in the new 'high-energy physics'. This new subfield, which had emerged from nuclear and cosmic-ray physics, involved the study of a new class of subnuclear particle released by bombarding nuclei with high-energy particles from an accelerator. The postwar respect for the awesome weapons and devices that had been produced by physicists had provided generous government grants to advance research into the deepest levels of the atomic nucleus.

I was given the goal of building a 'Wilson cloud chamber', a device that could render visible the tracks of energetic particles made in the accelerator. No one at Columbia had any experience in this area, but Rabi — with wisdom and political cunning — had invited several experts to come to Columbia and help.

In 1948, I spent about a month away from the laboratory studying for my PhD qualifying exams. Exam-taking, especially for me, was traumatic and I looked forward to continuing to test the cloud-chamber device that we had designed from reading the literature.

Returning to the laboratory, I found a fellow mopping the floor and singing a fragment of Italian opera. As I entered, he snapped the mop in a military style and introduced himself: "Bernardini!" "Yes," I assured the new janitor (so I thought). "But be careful not to put water on all those wires." It took another 20 minutes to clarify that Gilberto Bernardini was not a new janitor, but a visiting professor from Rome with a very distinguished career in cosmic-ray physics. His English was primitive, mostly learned by reading the physics journals. For example, "Good evening" (it was morning), "It is evident that this is a nice day". More accurately, "Dis issa nice a day".

Bernardini had had a very difficult time in Italy during the war. Arriving in Columbia he was — if anything — as insecure as I was. But he soon started to change my insecurity and restore my original enthusiasms. He was 'in touch'. Through Enrico Fermi, his teacher, he knew the latest physics gossip and therefore he stimulated ideas on how to use the new accelerator. And the cloud chamber?

The principle was that one created all the conditions for rain inside a cylinder about 12 inches in diameter and 6 inches deep. However, the dense humidity created in this chamber requires some dust to trigger the formation of droplets. If the gas is too clean, no drops are formed. But an excited atom from which an electron was detached would serve. A train of droplets was the track of a particle that passed through the chamber. So we could 'see' subnuclear particles!

But my cloud chamber only gave a dense smoke. Bernardini looked at it. "Wazza dat?" He pointed to a long needle projected into the chamber. "That's my radioactive source." "Dakid oud!" he said. So I took it out, the smoke disappeared and absolutely lovely tracks appeared. Bernardini started dancing.

Later, we made a proportional counter by machining a brass cylinder and stringing a wire through it, which exited through an insulating tube. A high voltage was applied while we flushed the cylinder with an appropriate gas. As we watched the results on an oscilloscope, pulses suddenly appeared.

"Izza counting!" Bernardini screamed. He lifted me (I was heavier than him) and danced me around. "What's happening?" I asked. "We seeing da particles from cosmic rays!"

He must have seen this thousands of times, but he never lost his sense of wonder. Some particle originating billions of miles away in some stellar catastrophe was being recorded in our cylinder on the tenth floor of the Columbia physics building! Fantastico!

Bernardini taught me the marvels of familiar phenomena. He would even turn on the lights in the laboratory, and turn them off and on again. How did this happen? What series of phenomena were organized to bring us light?

In my subsequent 40 years of research, there have been times of stress, frustration and disappointment. These are suffered in the hope that a discovery will bring everlasting joy, fame and fortune. But this is not a life. The fun and excitement must be daily — in the challenge of creating an instrument and seeing it work, the joy of communicating to colleagues and students, the pleasure of learning something new, in lectures, corridors and journals. And underlying it all, the sense of wonder that nature is comprehensible. The Italian visitor was my turning point. ■

Leon Lederman is director emeritus of Fermi National Accelerator Laboratory in Batavia, Illinois 60510-0500, USA.