

RETROSPECTIVE

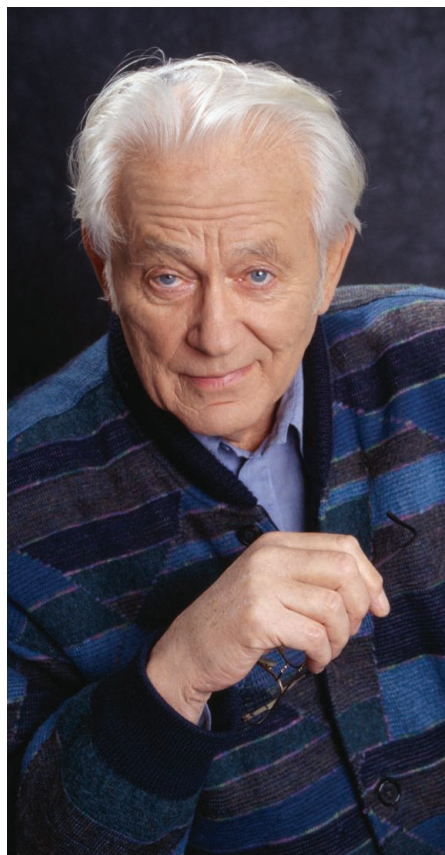
Georges Charpak (1924–2010)

Yves Quéré

Georges Charpak was 7 years old in 1931 when his parents, Maurice and Anna, decided to leave their village in Poland and move to Paris. “I have a wonderful memory of my primary school,” he often said, “where French quickly began to take over from the Polish of my youth, and where I set about indiscriminately devouring everything that came my way: mathematics, history, science, literature... Very soon, I felt that I had a debt to an education system that had given me so much.” Brilliant studies, then war, the German occupation, and the French Resistance (he had a false identity card, and was arrested and deported to the Dachau concentration camp). All this made his youth an adventure worthy of a novel, in which conviction and courage went face to face with tragedy.

Then there is Georges after the war, beginning his research at the Frédéric Joliot-Curie laboratory in Paris, where he was soon gripped by a passion for particle detectors. It never left him. Drawn to the European Organization for Nuclear Research (CERN) in Geneva by the American physicist Leon Lederman, he would spend most of his career there as an impassioned physicist and an inspired experimenter. He built his multi-wire proportional chambers for electronically tracking the particles created by accelerators; they deposed bubble chambers, creating his fame and earning him the Nobel Prize in Physics in 1992. On his return to Paris, he was invited to join the *École supérieure de physique et de chimie industrielle de Paris*, by Pierre-Gilles de Gennes, then the director. There, he continued his work, this time in radiology, developing detectors that cut the exposure time needed for radiography by several orders of magnitude. At the same time, he was a prominent campaigner against the proliferation of nuclear weapons, and in favor of nuclear power stations.

Georges was then seized by another passion. In 1995, while visiting schools in Chicago that his friend Lederman had helped save from violence and ruin through science taught “hands-on,” Georges decided—with a faith that would have moved mountains—to reform the teaching of the natural sciences



in French primary schools. With the support of a few teachers who were already working in that direction, and backed by a unanimous vote of the French Academy of Sciences in 1996, he launched *La main à la pâte* (“hands in the dough”). At first, several hundred schoolteachers embarked upon the adventure, and then several thousand, with the full backing of the French Ministry of Education. It involved teaching so that children learned science by doing it, and not just by reading about it on the blackboard or on a screen. Soon, Georges was joined by fellow members of the French Academy, and by a group of teachers and enthusiastic scientists. Fruitful contacts were made with other pioneers, such as Jerry Pine at the California Institute of Technology and Karen Worth of the Educational Development Center, headquartered in Boston.

A team formed under the aegis of the French Academy, and it soon defined a strategy and tactics. The strategy was founded on a single priority: to use science to support

A generous Nobel laureate had a passion for particle detectors and reforming science education.

the child’s mental development. This meant inculcating a taste for questioning, a sense of observation, intellectual rigor, practice with reasoning, modesty in the face of facts, an ability to distinguish between true and false, and an attachment to logical and precise language. The tactics involved creating and organizing support for a major Web site, now consulted by a vast number of teachers, creating “pilot centers” around the country where *La main à la pâte* was rolled out on a model basis, and creating a prize for the best classes, to be presented annually by the minister at the French Academy’s hall of honor. Today, Georges Charpak’s scheme is officially endorsed by the ministry, and about 40% of French primary school teachers have adopted the approach.

Far beyond France, however, a similar trend was seen in the years around the turn of the millennium. Academies—such as the U.S. National Academy of Sciences, led by the determined action of its president, Bruce Alberts (now editor-in-chief of *Science*), the Swedish Academy, and a number of others—followed parallel paths. Networks formed, and an increasing number of international meetings and colloquia took place. *La main à la pâte* appeared in Colombia, Brazil, Argentina, Chile, and also, among many others, in China, Malaysia, Turkey, Afghanistan, and Cameroon. As for Europe, it has begun to organize itself around the Pollen and Fibonacci projects, funded by the European Commission, while the IAP, the global network of science academies, has made the teaching of science to children a sort of flagship for its international action.

At the heart of this national and international blossoming was the smiling but inflexible Georges, acting in favor of the children of the world. His enthusiasm, his strength of persuasion, his humor, and his charm were determining factors. His death, on 29 September in Paris, has deprived us of an outstanding man; a man who abhorred sectarian mindsets, compromise, bad faith, intolerance, the taste for power, and lies; a man who returned 100-fold the debt he believed he owed; a man who loved life, music, culture, friendship, science, action, and always going that bit further. Georges Charpak has left an indelible mark on all those who approached him, through his generosity, his youthfulness, and his passion.

10.1126/science.1198962

Académie des Sciences, Délégation à l’Enseignement et à la Formation, 23 quai de Conti, 75006 Paris, France. E-mail: yves.quere@academie-sciences.fr