Stuart Levy

Stuart Levy pioneered research into the dangers of misusing antibiotics. He died on Sept 4, 2019.

Stuart Levy enjoyed being a twin. At high school in Wilmington, Delaware, when April Fool's Day rolled around, he and his brother Jay would switch identities. You won't be able to get away with that kind of thing when you get to college, warned their tenth-grade teacher. But in their sophomore year they did just that. Stuart decamped to Wesleyan University, where he ruined a music exam on Jay's behalf, while Jay spent the week at Williams College, where Stuart was majoring in literature. "When classmates suspected a change, we answered by stating our wish to be considered individuals and not a single entity", Stuart would later recall.

After college, the brothers went to medical school (their sister Ellen would follow the same path).

The eminent Japanese scientist Tsutomu Watanabe sparked Stuart Levy's interest in antibiotic resistance. Watanabe was the first to describe the behaviour of the molecular parcels that became known as plasmids. In 1962, Levy spent some months at Watanabe's laboratory at Keio University in Tokyo. "We worked in the lab without air-conditioning", Levy later told National Geographic. "It was very, very hot. Hot and humid." Every now and again, Watanabe would stand under a cold hose. After returning to the USA, he worked at the National Institutes of Health before joining Tufts University School of Medicine in Boston, Massachusetts, where he remained for the next 47 years. His team discovered the remarkable means by which drug-resistant *Escherichia coli* disarmed tetracycline: it pumped the antibiotic out of the cell. What an organism, to come up with such a bold and ingenious strategy! "Bacteria have seen dinosaurs come and they've seen them go", Levy explained to CBS's Dan Rather, in one of his many media appearances. "We live in the bacterial world."

Levy's grandest experiment took place on a farm 20 miles outside Boston, in 1976. The Animal Health Institute, a representative body for the pharmaceutical industry, was keen to show that using low-dose antibiotics in animal rearing had only positive consequences. They commissioned a study from Levy. He went down to a little town called Sherborn, to the homestead of the Downing family. At the back of the property stood a barn. Levy filled it with chickens. 150 were fed meals laced with tetracycline; 150 were the controls. The animals were kept carefully separated.

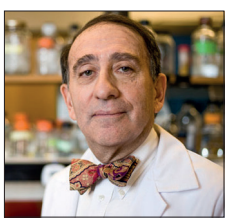
"We were providing feeds that had low amounts of antibiotics hoping to see what a small amount of antibiotic would do to the intestinal bacteria", Levy remembered in a 2017 interview. "The thought at the time was, that if you give an antibiotic to someone, or an animal, at low doses, you would get low-dose resistance". The children on the farm provided faecal samples to help the scientists understand how the antibiotics consumed by the chickens might affect the humans in the proximity. The results, to the horror of the study's funders, showed the emergence of multidrug-resistant bacteria in all the chickens, irrespective of whether they had initially received the tetracycline meal, and in the humans on the farm.

The US Food and Drug Administration (FDA) soon announced it would take action against growth-promoting antibiotics. But when subjected to fierce opposition from drug manufacturers and farmers, they backed off. So began Levy's lifelong mission to communicate to the medical profession and the general public the dangers of misusing antibiotics. And if there was one thing he knew how to do, it was to communicate. After all, he was a practicing physician at Tufts Medical Center and he spoke several languages. Besides, this was not complicated. Why on Earth were manufacturers putting antibiotics into chopsticks, mattresses, and yoga mats? Why were doctors prescribing antibiotics for viral infections? The French put it best: an untreated cold goes on for 7 days, a treated cold lasts a week. All it took was getting the message out there. "The whole objective is awareness", said Levy, in the 2017 interview.

Levy spoke to television networks, radio stations, newspapers, and countless scientific forums. He wrote a book, *The Antibiotic Paradox*, outlining in clear and snappy prose the urgency of the challenge. Not that there was any reason to think things were hopeless. "I'm an optimist down to my toes", Levy told one interviewer. Few would disagree; after all, this was a man who had been known to play the ukulele during a meeting. His perseverance paid off. In 2017, 40 years after first mooting the idea, and 1 year before Levy retired, the FDA banned the use of antibiotics for growth promotion. It was a landmark success. Now the mission falls to the innumerable scientists and advocates who Levy inspired.

Stuart Levy was born on Nov 21, 1938. He died on Sept 4, 2019. He is survived by his wife Cecile, and his three children Arthur, Suzanne, and Walter.

Talha Burki



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For the **2017 interview** see https://www.pyapc.com/insights/a-conversation-with-the-pioneer-behind-the-groundbreaking-study-in-antibiotic-resistance-dr-stuart-levy/