

Abstractions

LAST AUTHOR

Nanotubes caused a splash when they were first synthesized, following Nobel-winning work on 'buckyballs' — the spheres of 60 carbon atoms

formally known as buckminsterfullerenes. The tiny carbon tubes promised smaller, faster circuits for more powerful computing. But making and controlling them is tricky.

For the past decade, Charles Lieber, a chemist at Harvard University, and his colleagues have been pursuing a nano-alternative: small wires made of crystals. These are more easily assembled into electrical circuits than nanotubes — although they aren't such good conductors. Lieber and his prolific team first synthesized nanowires in the late 1990s; this week they reveal their high-performance nanowire transistor. Lieber discusses the state of his art with *Nature*.

You've published a lot of high-profile papers. Any secret to your productivity?

I don't think there is a 'secret'. Productivity stems from my motivation to produce research that will impact society in a positive way. I always ask myself, "Why is this important rather than simply interesting?"

What's the difference between using nanowires and nanotubes?

Semiconducting carbon nanotubes can possess perfect molecular structure. But this perfection does not readily allow for the variations in composition needed to support new functions. Nanowires have an advantage because their diameter can be easily varied, which means we can build devices that use substantially larger currents. Also, nanowires can be assembled so that they all behave the same way electronically, and this allows us to create multi-nanowire devices and complex circuits.

So, which is better?

It's not a question of proving something is better. We want to define the limits of nanowires, push them as far as we can and find real applications. There's room for many different types of nanostructures in the future. As long as people focus honestly on the science, things will progress naturally — although I do feel some are too narrowly focused on nanotubes.

How does your paper strengthen the argument in favour of nanowires?

Our work is state-of-the-art. We cannot yet judge whether nanowires will become the next microelectronics technology, because so many other issues need to be resolved — such as manufacturing and economics. But we have shown that nanowires are a viable alternative to silicon chips and nanotubes. Now we're focusing on the next big questions.

MAKING THE PAPER

Horacio Frydman

Bacteria exploit stem cells and their surroundings in order to reproduce.

As a grad student, Horacio Frydman was studying sterile fruitflies when something unusual caught his eye. "One of the mutant lines had a strange pattern of staining in the part of the ovary close to the egg cells," he recalls. "Almost everybody thought it was an artefact." But after taking a closer look with an electron microscope, he concluded that the staining was caused by infectious bacteria — more precisely, *Wolbachia*.

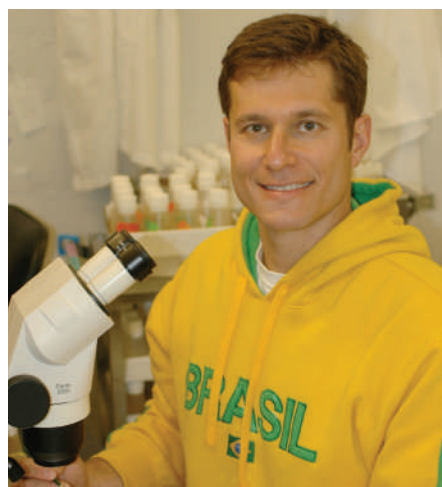
Wolbachia is extremely adept at infecting all types of insects. It also invades small parasitic worms, such as the filarial nematodes that cause river blindness and elephantiasis in places such as Frydman's home country, Brazil.

The bacterium typically inhabits cells in the testes and ovaries of its host, and is passed on from generation to generation through the mother. But until recently, no one knew which cellular mechanisms *Wolbachia* exploits to infect its host and spread so successfully down the generations.

"I saw *Wolbachia* as an opportunity to combine my interest in fruitfly development with studying host-parasite interactions in tropical diseases," says Frydman.

So after completing his PhD work in the lab of stem-cell researcher Allan Spradling, at the Carnegie Institution of Washington, Frydman wrote a proposal for examining the transmission of *Wolbachia* in fruitflies (*Drosophila*). He then looked for a lab that would take him. "That put me in the unusual position of having a project without having an actual job," he says.

Eventually, he found a home in the laboratory of Nobel laureate Eric Wieschaus at Princeton University in New Jersey. "Although Eric had never previously worked with *Wolbachia*, he generously allowed me to bring my own project to his very successful lab," enthuses Frydman.



ANGELA BASILE

His first step was to improve the reagents and methods used to visualize *Wolbachia* in living and fixed tissues. Armed with the right tools, Frydman found that the bacteria clustered in two places in the germarium, a part of the fly's ovary where the development of eggs begins.

Having trained in Spradling's lab, Frydman quickly realized that the clusters were in a region known to include two or three of the somatic stem cells that generate structures to protect the embryo during development. But the *Wolbachia* was not inside the stem cells themselves. Instead, as reported on page 509 of this issue, the bacteria were found in the surrounding 'niche', a microenvironment that provides stem cells with the factors needed for their specialized properties.

"This positioning probably facilitates *Wolbachia* transmission and may have a role in the success of the parasite," says Frydman. Indeed, it is possible that by homing in on the niche the bacteria are able, like stem cells, to renew and amplify themselves, and then infect many eggs.

Frydman now plans to explore what *Wolbachia* can teach us about the stem-cell niche itself. "We are only just learning about the niche, but the bacteria have been recognizing and living in it for millions of years." ■

QUANTIFIED NEW ZEALAND

A numerical perspective on *Nature* authors.

At the Institute of Geological and Nuclear Sciences in New Zealand, Cornel de Ronde leads the offshore minerals programme, conducting research on submarine volcanoes. De Ronde spends three to four weeks at sea each year, surveying volcanoes and collecting samples.

Survey work is tough, he says. He does 12-hour shifts, often at night in pitching, rolling seas, with lots of noise and little privacy. But it can be very rewarding. The field is still in its infancy and, as such, offers its participants the opportunity to witness things never seen before. A striking example is the discovery of an erupting submarine volcano, witnessed by de Ronde and his colleagues during the 2004 Ring of Fire expedition to the Mariana arc, and

US\$600,000 is spent annually by de Ronde's volcano research project.

17 authors from the United States, Canada, New Zealand and Japan contributed to the paper describing submarine volcanic activity published in *Nature* this week.

15 submissions to *Nature* this year have come from New Zealand (<1% of all submissions).

42 days is the longest de Ronde has