



# PAUL HEBERT

## Bar-coding life

[BY CHRIS JONES]

**W**HEN HE WAS six years old, Paul Hebert gathered butterflies and moths in his backyard, curating his collection the way taxonomists had since the eighteenth century. Color, shape, behavior—these were our only means to distinguish one species from another, and for comparison's sake, we filled museum warehouses with dead parrots and glass cabinets with beetles anchored by pins.

Years later, having become an evolutionary biologist at Ontario's University of Guelph, Hebert yearned for a more efficient way to catalog the planet's life. After nearly three centuries of sweaty fieldwork, only 1.7 million species had been described by the world's scientific community. By even the most conservative estimates, there were eight million to go.

"I've always been on the lookout for the silver bullet that would

shoot to the heart of biodiversity," the fifty-nine-year-old Hebert says. Inspiration struck when he was lost in the aisles of a supermarket, marveling at how every item on every shelf could be identified by its twelve-digit bar code. Why couldn't DNA, with all of its possible combinations, be scanned the same way?

In 2002, Hebert shared his idea with his peers, most of whom waved it away as though it were one of the sixteen hundred known species of European midge. But Hebert persisted, eventually finding his silver bullet in a mitochondrial gene known as CO1, which is harbored by every living thing larger than a microbe. The unique order of the 648 base pairs in **that gene made for the perfect bar code:** long enough to distinguish species with

98 percent accuracy but short enough to be quickly and cheaply sequenced.

Next, Hebert set about building a vast

bar-code library, beginning with the creatures he knew best, the butterflies and moths in his backyard. Birds and fish followed, as did \$30 million in research grants. This fall, Hebert's tiny lab was replaced with a twenty-thousand-square-foot factory, complete with a small army of robots busily trying to meet what he calls "our production goals." So far, more than 160,000 specimens have been cataloged. With his increased capacity, Hebert hopes that he will have banked bar codes for five hundred thousand species by 2014. "I would like to see the job finished, so it requires some haste," he says.

There remains time for dreaming, however. Within a decade, Hebert envisions every family owning a handheld bar-code reader. Children will find a tuft of fur in



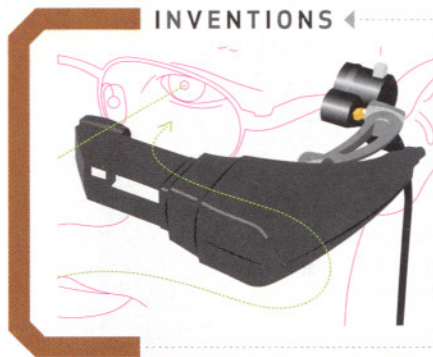
Above, the CO1 gene—the bar code—of the imperial moth, below. At left, a simulated portable bar-code reader.



the forest and learn within seconds that it came from a white-tailed deer; their parents can tell whether the ground beef in the fridge is in fact all beef. And more practical applications are surfacing almost daily. Already, Hebert is working with the Food and Drug Administration to help curb the illegal trade in certain species, revealing, for instance, that crates of imported "cod" fillets were in fact contraband fugu, the poisonous Japanese puffer fish.

Hebert's detective work has also uncovered **hundreds of new, even unsuspected species.** Every shipment from allies collecting in the field risks ballooning his workload, such as the supposedly single species of Costa Rican butterfly that turned into ten. "The numbers are intimidating," he says. "They've scared the living hell out of me all my life. But we're finally wrestling this thing to the ground"—and at last without pins.

### INVENTIONS



**[TRANSLATION]** IT USED TO BE THAT DINING restaurants in Pakistan soon change. Alex W... University, has developed the translations, su... Technical challenges grunts, so writing s... working on robust r... that the goggles wil...

