



MUSKOX (*Ovibos moschatus*)



HERMIT CRAB (*Coenobita* sp.)



EYELASH VIPER (*Bothrops schlegelii*)



JUNGLE NYMPH WALKING STICK (*Heteropteryx dilatata*)



AFRICAN PYGMY HEDGEHOG (*Atelerix albiventris*)

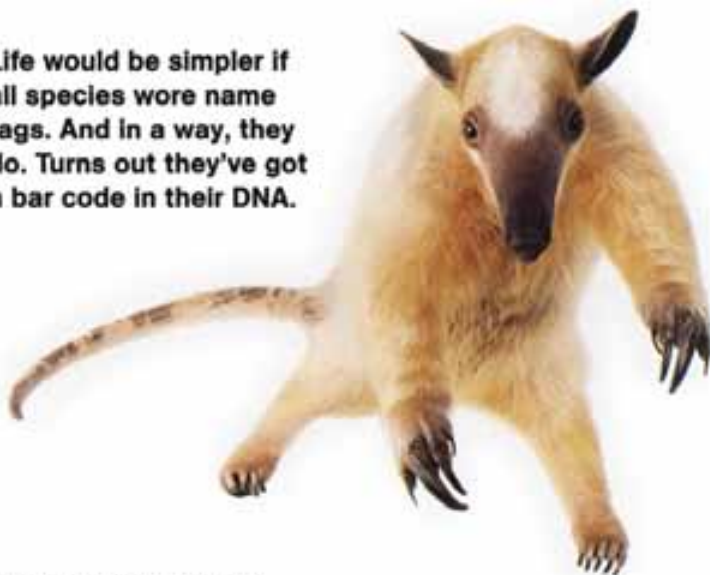


AFRICAN ELEPHANT (*Loxodonta africana*)

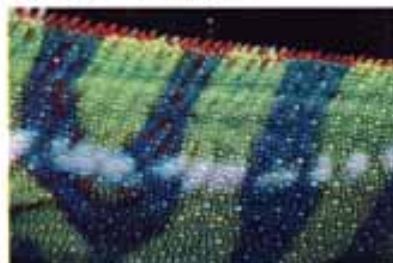


BONGO (*Tragelaphus eurycerus*)

Life would be simpler if all species wore name tags. And in a way, they do. Turns out they've got a bar code in their DNA.



TAMANDUA (*Tamanua tetradactyla*)



PANTHER CHAMELEON (*Furcifer pardalis*)



EASTERN SCREECH-OWL (*Megascops asio*)



MOON JELLIES (*Aurelia aurita*)



KATYDID (*Orchelimum* sp.)



BLACK SWALLOWTAIL BUTTERFLY (*Papilio polytes*)



VIETNAMESE MOSSY FROG (*Theloderma corticale*)



GOLDEN LION TAMARIN (*Leontopithecus rosalia*)



FLORIDA SCRUB MILLIPEDE (*FLORIDOBOLUS PENNERI*)



FIVE-LINED SKINK (*PLESTIODON* SP.)



PALLID BAT (*ANTROZOUS PALLIDUS*)



PALM COCKATOO (*PROBOSCIGER ATERRIMUS*)



GREEN TREE PYTHON (*MORELIA VIRIDIS*)



SILVER-STRIPED HAWK MOTH (*HIPPIOTON CELERIO*)



BLACK LEMUR (*EULEMUR MACACO*)

Scanning Life



DNA BAR CODE FOR *HIPPIOTON CELERIO*



TIGER (*PANTHERA TIGRIS*)

IF YOU TURN ON A LIGHT AT NIGHT in the mountains of Papua New Guinea, says Paul Hebert, you will collect some 2,000 species of moth. Moving up the mountain a bit will net you a different but equally daunting crowd. As a young postdoc in the 1970s, Hebert, now an evolutionary biologist at the University of Guelph in Ontario, spent five years trying to make sense of that fluttering confusion, before finally deciding it was beyond his or any human's capacity. For two decades after that he retreated to water fleas, of which there are only 200 species. Then in 2003 he did something new. In a paper that year he began by describing the diversity of life as a "harsh burden" for biologists, and proceeded to suggest some relief: Every species on Earth could be assigned a simple DNA bar code, Hebert wrote, so it would be easy to tell them apart.

The bar code Hebert suggested is part of a gene called *CO1*, which helps produce the energy-carrying molecule ATP. *CO1* is so essential that every multicellular *(Continued on next page)*



LEMUR LEAF FROG (*NYCTANOLIS LEMUR*)



HAWKSBILL TURTLE (*ERETMOCHELYS IMBRICATA*)



COYOTE (*CANIS LATRANS*)




LITTLE GREENBUL (*ANDROPADUS VIRENS*)

THE BIG IDEA



G T C A



Tolypeutes matacus, the southern three-banded armadillo of South America, can close its shell in a tight ball. Like all creatures, it has a bar code represented by four colors—one for each of the DNA bases (G, T, C, and A).

organism has it. But there is enough variation in its sequence—each of the 600-odd spots in the bar code region can be filled by any of four different DNA bases—that two species rarely have the exact same one. Such differences in a gene are readily scanned by machine even when the animals themselves might confound an expert; Hebert's group is now sequencing a thousand specimens a day. They've bar coded nearly 40,000 species of moth and butterfly already. The technique has commercial as well as scientific promise. Mislabeling of fish on menus is rampant, it turns out.

Bar coding has spread throughout the animal kingdom and even to plants and fungi. With a seal of approval from the United Nations, which has declared 2010 the International Year of Biodiversity, researchers in 25 countries are now aiming to bar code 500,000 species—of the 1.7 million already named on Earth—by 2015. "I'm convinced

this approach is scalable to the planet," says Hebert. "Any species humans encounter frequently will be bar coded by 2025."

Some biologists dislike that grand plan; they worry that bar coding, which is best at identifying species that have already been described, will steal scarce research dollars from the more valuable work of describing unnamed species. Hebert sees the technique as popularizing biodiversity at a time when it is vanishing fast. People are now sending him specimens from their backyard to identify, but within ten years, he thinks, the technology will follow the path of GPS: Someone will invent a handheld DNA bar coder. "I can imagine every kid getting one of these in his or her Christmas stocking," Hebert says. When those kids grow into postdocs, they'll be better equipped to plunge into the wilds of New Guinea and sort out the moths. —Robert Kunzig