

## "Barcoding life" on InnovationCanada.ca



### Barcoding life

Churchill, Man., is the epicentre of a project that aims to identify every species on Earth

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#### Environment Nature DNA University of Guelph Features



Zoom

A caterpillar of the moth *Gynophora groenlandica*, or wooly ice worm, strides across an ice sheet that covers the flower, *Dryas integrifolia*, or Mountain Dryas found in Churchill, Manitoba.

*Paul Hebert, University of Guelph*

Biologist **Paul Hebert** couldn't believe his eyes when a colleague found a species of moth native to Mexico fluttering over the tundra at the fringes of Hudson Bay in Churchill, Man., one summer day in 2006. The huge black witch moth with a 20-centimetre wingspan had never before been found that far north.

"I thought a Mexican colleague of mine had played a great stunt on me and brought the moth up to the tundra to give me the thrill of my life," says Hebert, a Canada Research Chair in Molecular Biodiversity at the **University of Guelph**.

But the migratory moth, which breeds in Mexico, had flown to the Arctic under its own power. And it is just one example of the hundreds of species that Hebert, his team from Guelph and colleagues from around the world have identified as part of an ambitious DNA bar-coding project that kicked off in Churchill in 2006.

After taking a short, standard sequence of DNA from the moth's genome, the team sequenced the sample, registered it as belonging to the black witch moth and entered its DNA signature the location where it was found into the barcode of life data system, an informatics platform for barcode records. The researchers are hoping that the database will one day hold a DNA sequence, or "barcode," for every species on Earth.

"We're probing the genetic structure of the planet," says Hebert, who invented the DNA barcoding system and is the director of the **Biodiversity Institute of Ontario**. "This is the grandest of genomic projects."



Zoom

*Castilleja raupii*, commonly known as Indian paintbrush, is one of the many species from Churchill, Man., whose DNA has been sampled for the Barcode of Life project.

*Paul Hebert, University of Guelph*

To date, biologists and taxonomists have identified 1.7 million species through traditional methods such as capturing and mounting specimens or drawing, photographing and describing them. But Hebert and his colleagues think this is just a tiny fraction of life that exists on Earth.

"People in my business believe at least 90 percent of the species on the planet have never been codified," says Hebert, "so we need to speed up their discovery."

Ultimately, the **International Barcode of Life Project** — the first phase of which kicks off at the CN Tower in Toronto on September 25 — will bring together researchers from 25 countries in a long-term effort to identify species. The DNA barcodes will be housed in a digital repository at the University of Guelph.

But to begin, Hebert and his team have been barcoding the multicellular organisms of Churchill. They selected Churchill, known as the Polar Bear Capital of the World, because of its relatively simple ecosystem, which was estimated to include some 6,000 species. They also chose it, says Hebert, because the Arctic is a core part of Canada and the area most affected by climate change.

The researchers thought it was reasonable to collect 6,000 samples of mammals, invertebrates, plants and lichens, while fine-tuning their genome-extraction and digital-identification systems. But since the project began four years ago, Hebert's team has discovered more than 200 species of moths and butterflies alone that had not been previously reported in Churchill (including the black witch moth), as well as huge numbers of species of parasitic wasps and some flies. Hebert believes there could be upward of 15,000 multicellular organisms in Churchill and is now seeking funding to establish an Arctic biosurveillance network at sites across the Arctic. "Churchill will still be the major site at which we chase the grand goal of registering all life," he says.



Zoom

The delicate giant sulphur butterfly (*Colias gigantea*) perched on a Northern Sweet Vetch plant (*Hedysarum mackensii*). Both were sampled in Churchill.

*Paul Hebert, University of Guelph*

Thanks to Hebert's DNA barcoding system, researchers can easily identify new species, as it allows them to distinguish between species that look alike but aren't the same. Eventually, researchers will be able to identify species simply by scanning little strings of DNA — the barcodes — and comparing them with the samples stored in the digital library.

This digital-identification system will record not only the names and locations of different species but also their range, where the juvenile and adult members of a species live and any other information researchers can collect about their habits. Registering all life will be critically important, says Hebert, to help preserve the most genetically diverse species on the planet by, for example, designing nature reserves.

"Against the backdrop of looming mass extinction," he says, "it's critically important to know where species live, how many there are and how they are related to one another."

Biologists are also currently attempting to barcode all the multicellular organisms that live in a warmer part of the globe: Moorea, an island in French Polynesia.

Once all international partners have officially launched the project in September, Canada will be home to the project's secretariat, to its largest sequencing facility and its central informatics platform at the University of Guelph will hold a million specimens or records of them. According to Hebert, Canada has generated 75 percent of all the barcoding records that have been registered so far and is at the heart of the project.

"For me, the current project is a dream — to be working with people around the planet who are biodiversity specialists, gathering life," he says. "We're thrilled to be at the nexus of this, and we're proud for Canada."