



# *The IMMORTAL Devil*

A voracious cancer threatens to wipe out an iconic Tasmanian species and destabilize the island's ecosystem. Can biologists trick the disease into taming itself?

BY JULIE REHMEYER





CLOCKWISE FROM TOP LEFT: SIMON DE SALIS/TASMANIA DEPARTMENT OF PRIMARY INDUSTRIES; PARKS, WATER AND ENVIRONMENT (DHPWE); JOHN KADLACEK; LARRY TOLLE/DEVIL ARK; GARY BROWN/DEVIL ARK; SAVE THE TASMANIAN DEVIL PROGRAM (STDP); DHPWE; JOHN KADLACEK; DHPWE; JOHN KADLACEK; DHPWE



**M**ENNA JONES PEERED into a trap, and a Tasmanian devil peered back. Its gaze

was somehow off. Its face seemed misshapen, and its jaw was raw and red. Perhaps, she thought, the swelling was an infected wound. Many devils were torn up at the end of the breeding season, after a month of winning and defending mates.

Jones, a biologist at the University of Tasmania, was trying to decipher the social structure of the island's iconic creature, the largest meat-eating marsupial in existence. Were the devils promiscuous, as many researchers suspected? Which were studly and prolific, and which were losing the reproductive race? This fellow was one of many helping Jones answer those questions in June 2001 at her study site on the Freycinet peninsula, a crooked finger of land in eastern Tasmania, an island state off the southern coast of mainland Australia.

Jones reached for a canvas sack, tipped the cage gently and shook the black, beagle-size animal into the bag. Then she sat on the ground, legs wrapped around him. Gripping him firmly, she began to pull the bag back to measure his head. It was a dance she'd performed hundreds of times, moving smoothly and predictably so the devils learned what to expect.

Sometimes after she released a devil, it stayed in her lap and sniffed the sunscreen on her arm or buried its furry face in her armpit to hide from the sun. Although this devil

was new to her — he was at the neck of the peninsula, which she visited only once a year — she often trapped the same devils dozens of times over the years, watching them grow from tiny imps in their mothers' pouches through grizzled old age at around 5.

When she pulled the bag back from the devil's face, her soothing dance faltered. A mass obliterated his right eye and erupted into an oozing, red-and-black cauliflower across his cheek. Another swelling deformed his left cheek into a deceptive chipmunk-chubbiness.

These facial growths were ominously familiar to Jones, though few others had ever seen one. Two years earlier, she'd discovered strange tumors on a third of the devils she'd trapped while working 100 miles to the north. At the time, she thought perhaps they'd been exposed to some toxin. Lacking a camera, she could take only measurements and descriptions to a wildlife veterinarian. He told her the only way he could figure out what ailed her devils was if she euthanized one and brought it to him. "I was horrified at the thought that you'd euthanize a devil just to find out what it was sick with," Jones told me, sitting in her office in the port town of Hobart. "Interesting to think back on that now that tens of thousands have died."

Over the next days of Jones' 2001 trip to Freycinet, two more strapping 3-year-old males appeared in her traps with tumors on their faces. One of these tumors spread across the devil's jaw and then dissolved, leaving a gaping hole. He could no longer eat. With no qualms about euthanizing this doomed creature, Jones brought him to a veterinary pathologist. Cancer, the veterinarian confirmed, but he wasn't sure what kind.

The next January, Jones spotted tumors blooming on the faces of devils five miles farther down the peninsula — devils she'd known for years. When she returned in April 2002, the blight had marched still farther. By June 2002, when she returned to the neck of Freycinet, she caught only 14 devils, rather than her usual 50 — and a third of them had tumors.

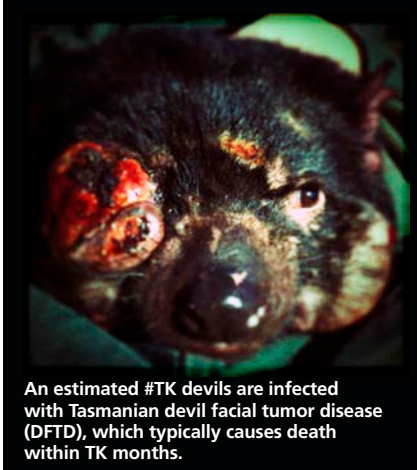
The disease was spreading. Somehow, it seemed, cancer had evolved to become contagious.

Now, more than a decade later, the tumor is finally beginning to reveal its



Biologist Menna Jones of the University of Tasmania has led the charge to thwart the contagious cancer that threatens Tasmanian devils.

*These devils are suffering from a malady so odd many researchers scarcely thought it possible*



An estimated #TK devils are infected with Tasmanian devil facial tumor disease (DFTD), which typically causes death within TK months.

tricks. These devils are suffering from a malady so odd many researchers scarcely thought it possible: One devil's cancer has learned how to survive in other devils' bodies, and one tumor is now threatening to wipe out an entire species — as well as destabilize the Tasmanian ecosystem and likely cause the extinction of many other marsupials that survive only in Tasmania.

Fearing such a calamity, the Tasmanian government, working with a network of biologists, has begun quarantining healthy devils in zoos and on isolated islands. If

the cancer kills off all other wild devils, this "insurance population" could, at least in theory, help reboot the species. (See sidebar, page TK.) Meanwhile, some of Jones' colleagues are trying to decipher how the cancer evolved in hopes of using the information to create a vaccine. But Jones puts better odds on figuring out how to hack evolution itself, so that the devil and its tumor will learn to coexist.

The big question is whether that can happen before the disease wipes out wild Tasmanian devils altogether.

Unraveling the mystery will do more than save one furry creature at the bottom of the world. The tragedy has given researchers a backstage pass to observe the evolution of cancer itself. No ordinary cancer can live as long as or divide as many times as the immortal devil from the original long-dead animal that spawned the current plague, but understanding the basic biology of the devil facial tumor disease, or DFTD, should shed important, new light on cancer writ large.

#### LIFE RAFT

Watching the Freycinet devil population crash in 2001 and 2002, Jones worried the survival of the species might be at risk. It seemed almost unimaginable — after all, devils were so common as to be pests. Their nighttime screeches regularly woke people at night and were frightening enough to have inspired early Tasmanian settlers to bestow the intimidating name on the small, shy creatures. Dead devils littered the roads, having fed on roadkill before sharing their dinner's fate. Farmers complained the devils ate their chickens and lambs. Most rural Tasmanians viewed devils a bit like Americans tend to regard raccoons or squirrels: ubiquitous, occasionally annoying, worthy of little thought.

But the devils' ubiquity was no guarantee of their survival. Biologists have theorized that a new and virulent disease can eradicate even a well-established species if it keeps spreading after the population gets sparse. So in late 2002, Jones sounded the alarm to the state government. Conducting a quick-and-dirty survey of devil populations across the state, officials found that devils in the northeast, where Jones first saw the disease, were nearly wiped out, and of the few survivors, many were already

infected. The disease seemed to spread during mating, when female devils fight off suitors and males bloodily compete for females. Devils bite each other on the face as they scrabble, and malignant cells can crumble off tumors like feta cheese, dropping into bite wounds.

Over the next several years, Jones watched the populations at her study sites fall by 50 percent a year. She kept feeding the new data into mathematical models that took into account factors such as the animals' age, migration patterns and disease prevalence in the population, and the models' predictions were bleak: Once the disease arrived in an area, devils there would vanish within 10 to 15 years.

Grim as the outlook was for the devils themselves, Jones' deepest concern was that if the Tasmanian devil vanished from the wild, it could take a big chunk of Australia's dwindling biodiversity with it.

More mammals have gone extinct in Australia than on any other continent. Nineteen mammal species have become extinct over the past 200 years, and more than a hundred more are threatened or endangered. Tasmania is Australia's one shining exception. Since it was settled in 1803, the island has lost only one mammal, the Tasmanian tiger (or thylacine) — a wolfish, striped, carnivorous, hopping marsupial. And the island state has served as a life raft: Four Australian species survive only on Tasmania, having been wiped out, or nearly, from the mainland, and 11 more are threatened on the mainland. Many of these creatures' names sound as if they've leapt from children's fables: the eastern barred bandicoot, the Tasmanian pademelon, the eastern quoll, the long-nosed potoroo, the eastern bettong.

The devil, which went extinct on the mainland around 5,000 years ago, is one of these Tasmanian survivors. And it is the thumb in the dam, preventing all these creatures from being swept from the Tasmanian landscape and thus into extinction. Devils fill a critical role in suppressing feral cats and foxes (which have been illegally introduced to the island but whose numbers have so far remained manageable) by preying on their young and competing for habitat and resources. If populations of these animals were to spread, as they did long ago on the mainland, they would slash a hole in the marsupials' life raft. "It's just like taking

## The Spread of a Killer Cancer

Since its first recorded sighting in 1996, Devil Facial Tumor Disease (DFTD) has maintained a steady westward march, depleting devil populations by as much as 90% along the way.



### TASMANIAN DEVIL

The largest marsupial carnivore, extinct on the Australian mainland for centuries, is now found in the wild only on the island state of Tasmania.

**SCIENTIFIC NAME:** *Sarcophilus harrisii*

**AVERAGE LIFESPAN:** 5-6 years in the wild.

**AVERAGE WEIGHT:** 18-25 pounds (males larger than females).

**APPEARANCE:** Black coat, usually with white patches; large head; strong jaws.

**VOCALIZATIONS:** Grunts, snorts and screams.

**HABITAT:** Found throughout Tasmania, but prefers open forest or mixed pasture and forest; dens in hollow logs, vegetation, caves or underground burrows.

**FEEDING:** Hunting and scavenging; commonly feeds in groups.

**CONSERVATION STATUS:** Endangered.

Like the Tasmanian devil, the Tasmanian tiger, or thylacine (*Thylacinus cynocephalus*, right), survived only in Tasmania after being wiped out from mainland Australia. But by the 1930s, Tasmanian sheep farmers slaughtered thylacines to extinction in an effort to protect them from preying on lambs. (In a 2006 article contemplating the fate of the Tasmanian devils, Menna Jones riffed on Oscar Wilde: "To lose one large marsupial carnivore may be regarded as a misfortune; to lose both would look like carelessness.")



wolves out of Yellowstone,” Jones says. “Losing the top predator sends the ecosystem out of balance.”

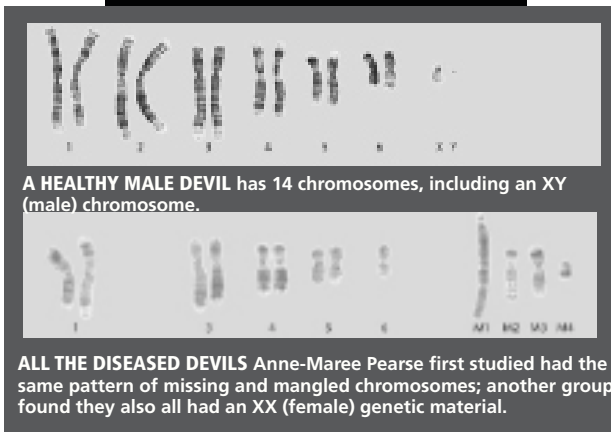
### CANCER AS PARASITE

Jones’ alarm spurred the state government to action, leading to the Save the Tasmanian Devil program in 2003, with Jones as an adviser. The program’s goals were to suss out the threat and devise a plan to meet it.

News reports about the devils’ plight sprang up around the globe. Anne-Maree Pearse, a retired cancer researcher living in Launceston, heard a radio story about the disease as she was driving and called the Save the Tasmanian Devil program offering to help.

In fact, Pearse was uniquely qualified to help. Decades earlier, she began her scientific career studying the genetic makeup of a species of flea that had a special taste for the Tasmanian devil. Then she applied her expertise to humans, studying chromosomal rearrangements in leukemia cells. As a result, Pearse was perhaps the only person in the world with expertise in both cancer and devils — and, though the relevance was not yet clear, in parasites as well.

The STTD program jumped at Pearse’s offer to help and supplied her with devil cancer cells to analyze. When Pearse put the first cancer cell under her microscope, she found that, as is common in cancer, its chromosomes were mangled: One pair of chromosomes was missing entirely, one lacked a partner, one was chomped off, and some leftover



A HEALTHY MALE DEVIL has 14 chromosomes, including an XY (male) chromosome.

ALL THE DISEASED DEVILS Anne-Maree Pearse first studied had the same pattern of missing and mangled chromosomes; another group found they also all had an XX (female) genetic material.

*The similarity could mean only one thing: These cells were clones of one another.*

bits were jammed together into extra chromosomes. When she looked at a cancer cell from another devil, she saw the same pattern — chromosomes that had shattered and reformed in precisely the same way. The third, too. The chromosomes from all 11 devils had the same deletions and the same extra bits put together in the same exact way.

The similarity could mean only one thing: These tumor cells were clones of one another.

Later, another group found that the

sex chromosomes in the jammed-together leftovers were always of the XX variety — female — regardless of the devil host’s gender. That meant the cancer cells weren’t mutations from the sickened devil, the way cancer ordinarily is. They had come from another devil entirely, a female undoubtedly dead for years. Her cells, though, lived on. A cancer cell line had become an organism that survived in other devils’ bodies, sucking nutrients from them — in other words, a parasite.

News of Pearse’s discovery quickly jumped across the Bass Strait to the Australian mainland, where it reached Kathy Belov, a newly minted immunologist. Belov had just earned her doctorate showing that marsupial immune systems were vigorous, much like our own. Given that, it seemed shocking that devil immune systems would fail to recognize and stomp out something as obviously foreign as another devil’s cancer cells.

She wouldn’t have been so surprised if the cancer were spread by a virus, since viruses (such as the papillomavirus, which turns human cervical cells cancerous) have had millions of years to evolve ways of evading the immune system. But Pearse had shown that no virus was involved; the cancer cells had transferred directly from one animal to the next. So why hadn’t the devils’ natural killer cells, their immune systems’ designated cancer assassins, detected the invasion?

One plausible explanation was that over the course of successive population crashes, the devils had become so inbred that their cells look identical — at least to the animals’ immune systems. Belov knew how to check this. An animal’s immune system detects foreign cells by scanning for proteins, called antigens, that stick out like flags from each cell. These molecular identity cards are produced by a set of genes collectively known as the major histocompatibility complex, or MHC. That’s why identical twins make perfect organ donors for each other: Only they have perfectly matched MHC genes.

Perhaps, Belov reasoned, all devils were like identical twins. If so, then different devils’ perfectly matched “identity cards” would prevent their natural killer cells from recognizing each other’s

## Fellow Mainland Survivors

Like the devil, the Eastern quoll (left), Tasmanian pademelon (center), and Tasmanian bettong (right) have all gone extinct from mainland Australia. They exist only in Tasmania, where the devil helps protect them from feral cats and foxes.



tissues as foreign.

Analysis of the identity cards initially supported her theory, showing only the tiniest of differences. But when Belov and her collaborators transplanted skin between pairs of devils, the edges of the grafts grew pink and scabbed over. The animals' immune systems were recognizing and rejecting the foreign skin after all. Apparently, their genetic similarity wasn't enough to explain the cancer's voracious spread.

Belov turned to another possibility: that the tumor was somehow obscuring its foreign identity card from the immune system. That is the case in another rare contagious cancer, canine transmissible venereal tumor (CTVT), a sexually transmitted disease in dogs traced to a single animal now dead for as long as 11,000 years. Instead of displaying the full complement of incriminating proteins on the tumor cell's surface, the dog cancer displayed just a few, obfuscating the invasion underway.

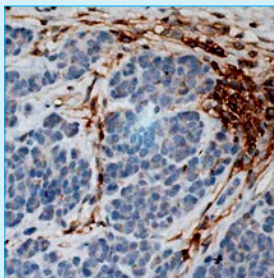
One of Belov's students, immunologist Hannah Siddle, now at the University of Cambridge, jumped at the opportunity to investigate this new possibility. To learn how the devil cancer cells might be blurring their identities, Siddle examined cells from multiple devils' tumors and saw that they were doing something even more radical: The tumor cells' surfaces presented no antigens and thus, no identity card at all. As a result, the devils' natural killer cells were giving them a free pass (though it remains a mystery why the missing identity cards didn't tip them off to attack).

If the cells displayed no identity card, Siddle figured, the MHC genes that produced the identity cards had to be missing. But no: They were intact, but inactive. "This was really exciting because it raised the possibility that we might be able to turn them back on, restore the proteins to the [cells'] surface, and use those cells as a vaccine," says Siddle.

And indeed, after Siddle added the gene for interferon-gamma — a chemical messenger that activates numerous genes involved in producing MHC antigens — to the DNA of cells cultured from devil tumors, the MHC genes functioned normally again, and the tumor cells' identity cards showed up, plain as day. She even found evidence that the devils'

## The Tumor That Won't Die

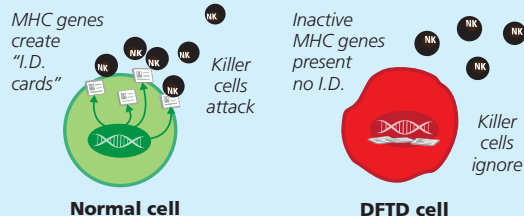
**HOW IT SPREADS:** Unlike normal cancers, where the disease-causing mutation is confined to one organism, Tasmanian devil facial tumor disease (DFTD) cells have evolved the ability to survive death by passing on to another devil's body. The blight started with one long-dead female devil, known as the "founder devil." Her cells live on in animals infected with DFTD today.



In this microscopic image, DFTD tumor cells (above, blue) have low levels of MHC protein, so they do not pick up a brown stain that adheres to the protein. Host cells (brown) in tissue adjacent to the tumor cells display the MHC protein strongly. [CK ALL WITH SIDDLE]

**HOW IT HIDES:** In a normal cell (below, left), genes encode instructions for a set of surface proteins known as the major histocompatibility complex (MHC). These molecules act as "I.D. cards" that the animal's immune system can detect and target with natural killer (NK) cells.

In a DFTD cell (below, right), inactive MHC genes present no identifiers, so the animal's natural killer cells ignore the threat.



immune systems were performing this interferon-gamma trick themselves: In some instances, tumor cells near the edge of the tumor, in close proximity to white blood cells, showed antigens that cells farther within the tumor mass lacked. This suggested to Siddle that in rare cases, the devils' immune systems were recognizing the tumor cells enough to release interferon-gamma and activate their MHC expression.

Siddle believes the results may offer all the pieces needed to develop a vaccine against DFTD. One strategy would be to take devil tumor cells from the wild back to the lab and turn on their MHC genes, making them recognizable to devils' immune systems. Then, with their evasion strategy disabled, those cells could be injected into healthy devils, whose immune systems could learn to mount a defense when they encounter the cancer in the wild.

"I think there's a good chance that this vaccine will work," Siddle says. "Whether we get something that's effective and cost-effective [enough] to be used in the field before DFTD moves through all of Tasmania is another question." Even if

researchers could protect large numbers of Tasmanian devils with a vaccine that was 100 percent effective, those animals' immunity would not be passed to their offspring; any vaccination program would need to go on indefinitely, a formidable challenge.

### EVOLUTION IN FAST-FORWARD

While Jones hopes Siddle and Belov succeed in developing a DFTD vaccine, she's not expecting the devils' salvation to be delivered through a needle. Instead, she looks to another strategy: helping the devil and the cancer evolve their way into peace.

Currently, the devil cancer is far too deadly for its own good: By killing its host, it's limiting its future prospects. That glaring evolutionary stumbling block should push it to become less virulent, while also pushing the devil to become more resistant over time.

CTVT, the infectious cancer that affects dogs, may point to the devil tumor's future. At perhaps 11,000 years old, CTVT is the oldest known line of mammalian cells on Earth, so it's no longer evolving much now. Through

random mutations in the past, it has already found the most advantageous arrangement of its DNA. In particular, it has learned the trick of receding about three to nine months after infection, displaying antigens on its cell surfaces so the dog's immune system can destroy it. It's a smart evolutionary tactic, allowing infected dogs to survive and breed, thus continuing their own species and providing future hosts for the tumor.

With time, most parasites pick up similar tricks, killing their hosts more slowly or not at all. Left to its own devices, the devil tumor may likewise evolve to be less deadly. The problem is time. Because

the devils are so geographically restricted and because there are so few of them, the cancer may kill them all before it has time to evolve in the ways CTVT has.

Jones' colleague Elizabeth Murchison, a geneticist at the University of Cambridge (and a Tasmanian expat), is working to understand the evolutionary process. The tumor is indeed evolving rapidly, she has found. Sequencing the cancer in 2007, she found that the tumor had picked up about 20,000 mutations; by now, it undoubtedly has many more. Most of those mutations are irrelevant, but a few of them are key, including those allowing the cancer to spread among devils. She has sequenced

hundreds of tumor samples from across the island and over time in an effort to understand how it evolves and how that affects the devils' survival rates.

Jones and Pearse hope that with this genetic knowledge in hand, it might be possible to find some way of nudging evolution along by selectively breeding devils that are particularly resistant to the cancer — or to cancers altogether. "I think there is a light at the end of the tunnel, but it's a very long tunnel," Pearse says.

Such insights could not only help rescue the devils; Murchison hopes they might help advance cancer biology more generally. All cancers are products of

## A Tasmanian Devil Insurance Policy

Even if wild Tasmanian devils are wiped out despite all of scientists' efforts, the devil won't go extinct. In 2005, a consortium of researchers began a massive captive breeding program to create an "insurance population" of healthy animals that could be reintroduced to Tasmania if devils go extinct in the wild. The program now has 600 devils in zoos and parks across Australia (and a small number elsewhere in the world).

But captivity changes animals, even genetically. Shyer, fiercer, more anxious animals may prosper best in the wild, but they often won't breed in captivity.

To preserve genetic diversity and guide breeding, geneticist Kathy Belov is sequencing portions of the DNA of every captive devil — an unprecedented level of sophistication for any captive breeding program. The current population includes 99 percent of the genetic diversity of all devils.

Still, devils in captivity for many generations may lose their wild behaviors. Small islands off the coast of Tasmania provide an opportunity for protected devils to live in the wild. In 2012, the Tasmanian government released 15 healthy devils onto Maria Island, a national park off Tasmania's coast. So far these animals — the only wild devils safe from the disease — are thriving. —JR



### DEVIL ARK

[1] An employee of Devil Ark, a protected habitat and breeding facility that houses about 130 healthy devils, cradles a resident. [2] Devils at the park roam in large, free-range enclosures. [3] Devil pups must compete from the day they're born as they try to out-wriggle their littermates to secure a berth in their mother's pouch. Later, only the fiercest manage to mate and evade predators. At Devil Ark, pups are kept separately after weaning so adults can't cannibalize them. [4] Devil Ark attempts to help devils retain wild behaviors such as scavenging.

### MARIA ISLAND

[5] STTD personnel transferred 15 healthy Tasmanian Devils to Maria Island in 2012. [6] Each devil was housed in a tubular trap. [7, 8] After their traps were opened, the devils snoozed, then crept out and vanished into the woods, the only devils in the world both safe from disease and free.

ALISON MACKAY/DISCOVER; TUMOR CELL PHOTO COURTESY OF HANNAH SIDDLE

natural selection, played out on the level of cells rather than species. A cell that develops a mutation allowing it to divide endlessly will outgrow its neighbors. One of its progeny might pick up a mutation, giving it the ability to gobble up nutrients faster, or to enslave other cells and force them to form blood vessels to feed it, or to spit a kind of acid to burn its way out of an organ and into the bloodstream, or to hide from the immune system, or to resist a particular chemotherapy. Each of these mutations gives the cell an advantage over its brethren, which it then outcompetes.

The cells from that one, long-dead female devil somehow picked up another highly valuable evolutionary trick: the ability to survive in another devil's body. In probing the devil tumor, researchers hope to learn what cancer does when the inconvenient obstacle of its host's death isn't enough to stop it. "Cancers are evolution in action," Murchison says. "Understanding the underlying evolutionary mechanisms that drive all cancers, not just the devil cancer, will help us understand and treat the disease."

### HOPE FOR A TRUCE

Even without that artificial nudge, nature appears to be taking a hint. After years of watching the cancer relentlessly take her beloved devils, Jones has gotten some tentative signs of a truce between the devils and the tumor. Even in the hardest-hit areas, the devils haven't disappeared entirely, the way Jones' models predicted a decade ago. Populations have fallen by 90 percent, but no more than that, and Jones believes some of those surviving devils may be acquiring some kind of resistance.

Jones' other source of hope, though tenuous, comes from a population of devils in the north-central part of the state, on the front lines of the cancer's steady westward march. Devils in the west are somewhat genetically distinct from those in the east, where the disease began, offering the possibility that they might be more resistant to the disease.

Jones herself is now far too busy orchestrating research projects to spend much time in the field. But her research assistant Rodrigo Hamede Ross has been studying this population since before the disease hit the area in 2006. One November day, I joined him at his study site near



A Tasmanian devil at Cradle Mountain.

*Populations at Cradle Mountain have dropped only 35 to 40%, compared with 90% elsewhere.*

Cradle Mountain, one of Tasmania's most popular national parks. Finding a devil in one of his traps, he recapitulates Jones' dance from many years before, shaking it out into a burlap bag, sitting on the ground and placing it firmly between his legs. He blows on the devil's nose and it opens its mouth. His assistant moves its tongue aside with a stick, and Hamede Ross peers inside its mouth. "Mara's healthy," he says of the 3-year-old mom, her nipples full of milk.

When he started at this site, he braced himself for the decimation he'd seen in other parts of the island, knowing the disease would arrive soon. But by 2008, it was clear that something was different here. He occasionally found tumors on the animals in his traps, but it was rare. The population wasn't crashing. Devils were still making it to old age. Then Hamede Ross saw something even more remarkable: In five devils, the tumors got smaller and went away.

He pricks Mara's ear and squeezes out

enough blood to fill a small vial. Murchison — sneaking in a field trip while home in Tasmania visiting family — watches over his shoulder. The vial may eventually come to her for sequencing, to help figure out what shields this population from the cancer decimating devils elsewhere.

A few traps after we leave Mara, Hamede Ross recognizes a 3-year-old male on sight: Bariloche. He isn't so lucky. Bariloche first showed up in Hamede Ross' traps with a tumor six months earlier, in May. Now, the tumor pushes out from his cheek. After examining him, Hamede Ross lets him go. "He hasn't lost molars and canines, so he can still feed," he says. "I'd guess he'll still be around in February but not in May."

Hamede Ross started seeing more sick animals like Bariloche in 2011, and testing of the tumors showed that a new, more virulent strain of the cancer had arrived. But his concern has alleviated a bit since then. "It's still pretty different from other places," Hamede Ross says. Devil populations in the Cradle Mountain region have dropped only 35 to 40 percent, compared with 90 percent declines elsewhere.

Right now, there's nothing the scientists can do to stop the spread of the cancer. They can only work to understand how it's behaving and watch for an opportunity to intervene. "We're trying to identify the mechanisms of evolution as it's occurring in the wild" into a strategy for saving the devils, Jones says. "Can we speed up the process to get coexistence?"

Sitting at her desk in Hobart, Jones isn't so tan as in older pictures of her, and it's been years since a devil has sniffed her sunscreen. But her mind is always on the devils that rely on her — along with the potoroos and bandicoots and pademelons that rely on them. And for the first time in more than a decade, she feels a cautious hope for their future. "If you asked me five years ago," she says, "I would have said that things look quite dire. If you ask me now, I feel quite optimistic, but I think it will take a long time. We're not going to see recovery overnight. It may take 20 to 30 years." Then her voice lowers. "And in the meantime, we don't want to lose anything." ■

**Julie Rehm**  
Discover a  
about ma  
N.M.



See video of Tasmanian Devils at [DiscoverMagazine.com/devils](http://DiscoverMagazine.com/devils)