

▶ patent sofosbuvir in Argentina.

“The science behind sofosbuvir doesn’t merit these patents,” says Tahir Amin, director of the Initiative for Medicines, Access and Knowledge in New York City. The activist group is involved in a dozen ongoing lawsuits related to patents for hepatitis C drugs — including the cases in India and Argentina, and others in Brazil, the European Union, Egypt and Ukraine.

Some of the suits argue that sofosbuvir, velpatasvir and daclatasvir are not sufficiently inventive to warrant a patent. Others challenge Gilead’s attempts to obtain additional patents on sofosbuvir by modifying it slightly, to extend the company’s intellectual-property rights — a practice called evergreening. “This battle is about trying to ensure that Gilead has the shortest possible monopoly,” says Leena Menghaney, who runs a drug-access campaign in South Asia for the charity Médecins Sans Frontières, which is supporting the lawsuits.

Gilead notes that it has taken steps to reduce the cost of its antiviral medications for hepatitis C — offering tiered pricing for sofosbuvir and other drugs, on the basis of factors such as a nation’s economic status and the volume of medicine that it requires. The list price for a 12-week course of sofosbuvir is US\$84,000

in the United States, \$50,000 in Turkey and Canada, about \$6,000 in Brazil and just \$900 in Egypt.

Gilead has also licensed 11 manufacturers in India to produce cheaper generic versions of its hepatitis C drugs for sale in 101 developing countries. The generic medications retail for \$300–\$900 per treatment course in countries where they are permitted; in return, Gilead

“This battle is about trying to ensure that Gilead has the shortest possible monopoly.”

receives a 7% royalty payment to keep its access-to-medicines programme running. This system draws on lessons that Gilead learnt during lawsuits and protests over access to HIV medications in the early 2000s, says Clifford Samuel, Gilead’s senior vice-president of access operations and emerging markets. “We got a tremendous amount of criticism in the early days of our HIV programme, and it refined us,” he says.

But that does not appease Amin, who says that Gilead’s deals with generic-drug manufacturers do not reduce the cost of its hepatitis C medications in middle-income countries. One analysis published last year found that

sofosbuvir and related drugs are too pricey for those nations (S. Iyengar *et al.* *PLoS Med.* **13**, e1002032; 2016). Using these drugs to treat every person infected with hepatitis C in Poland would cost 1.6 times the country’s annual expenditure on medicines for all conditions. The price of one course of treatment is equal to about six years of earnings for the average Pole.

Gilead intends to protect its patents in high- and middle-income countries, while working to improve access to drugs through discounts and tiered pricing. “We need revenue to put back into the development of drugs for other diseases,” Samuel says.

The company has already recouped its original investment in sofosbuvir. It acquired the drug in 2011 when it bought Pharmasset, a biotechnology company in Princeton, New Jersey, for \$11.2 billion. Since sofosbuvir hit the market in 2014, the drug and two similar medications have earned Gilead \$46 billion.

Menghaney expects the first hearings in the new wave of patent lawsuits to come in six months to a year. But she’s already looking to new frontiers. “I hope these battles in developing countries lead people to challenge weak patents and evergreening patents in the United States,” she says. ■

ECOLOGY

How to kill wild animals humanely for conservation

Guidelines aim to reduce pain and suffering in animals destined for culling.

BY EMMA MARRIS

Every year, trained professionals kill millions of wild animals in the name of conservation and human safety, and to protect agriculture and infrastructure. Commercial pest-control operators, government agents and conservationists trap beavers, poison cats, shoot wolves and gas rabbits in their warrens with varying levels of ethical oversight. Now, animal-welfare experts and conservationists are making a bid to ensure that these animals get the same consideration given to pets and even to laboratory animals that are killed.

People use methods such as carbon dioxide gas, drowning and painful poisons, to kill non-native or ‘pest’ animals, says Sara Dubois, chief scientific officer for the British Columbia Society for the Prevention of Cruelty to Animals in Vancouver, Canada. She thinks these methods are inhumane. But no one bats an eye, she says, because those animals are considered ‘bad’.

Dubois is the lead author of a set of guidelines

published on 9 February in *Conservation Biology* (S. Dubois *et al.* *Conserv. Biol.* <http://doi.org/b2c2>; 2017). The authors — a group of animal-welfare experts, conservationists and government researchers from around the world — hope the principles will become a model for the ethical review of projects that include killing wild animals. The principles are the result of a 2015 workshop in Vancouver.

A BETTER DEATH

The document incorporates the latest findings in animal-welfare science, which tries to quantify the pain and suffering animals experience in different situations, including when they are killed. It says that control actions should be undertaken only if they support a clear, important and achievable goal. In addition, the fact that an animal is non-native, or considered a ‘pest’ or ‘feral’, is not, by itself, reason enough to get rid of them.

The principles are sound, says Bruce Warburton of Landcare Research, a

government-owned research company in Lincoln, New Zealand. He was not involved in creating the guidelines, but has studied the animal-welfare impacts of pest control for two decades. Warburton adds that the principles would reduce the number of available animal-control tools and would be likely to incur a cost, at least initially.

Matt Heydon, a species-protection expert at Natural England, a government advisory group based in York, UK, says the principles tend to favour animal welfare a little more than do the ones his organization uses, but are broadly similar. “We approach the issue with a slightly greater emphasis on biodiversity, although animal welfare is also very important to us,” he says.

The US Department of Agriculture’s division of Wildlife Services kills millions of animals every year to protect agriculture and address other human–animal conflicts. A spokesperson noted that the department already follows “euthanasia guidelines from the American



Friend or foe? The brushtail possum is native to Australia, but is considered a pest in New Zealand.

Veterinary Medical Association, whenever practicable". And Australia's Department of the Environment and Energy says it follows similar versions of the principles reported in the new paper.

No set of guidelines can provide easy answers to the toughest calls. Brushtail possums (*Trichosurus vulpecula*) are a native Australian species regarded as an invasive pest in New Zealand. They are often killed using anticoagulants, which are the worst poisons

in terms of welfare, says Ngaio Beausoleil, an animal-welfare researcher at Massey University in Palmerston North, New Zealand, and an author on the paper.

Animals that ingest anticoagulants bleed to death over the course of days or weeks. But the poison's use is safer for pets and children because it takes so long to kill. If a child accidentally eats bait laced with an anticoagulant, there is still time to get them to a hospital and administer the antidote. With faster-acting

and more humane poisons such as cyanide, a family pet that inadvertently ate it could die before anyone could do anything about it. A third option, Beausoleil says, is to re-evaluate the need for killing the possums at all.

Island Conservation, a non-profit organization based in Santa Cruz, California, also uses anticoagulants when eradicating rodents in order to save endangered seabirds and other vulnerable island species, says Gregg Howald, the organization's North American regional director and an author on the paper.

But the organization is working on replacing or refining its method to come up with a more humane approach. The new guidelines are a call to innovators around the world, he says. "Bring us something that will work; we will be the first to adopt it." ■

CORRECTION

The news story 'Larsen C's big divide' (*Nature* **542**, 402; 2017) erroneously stated that two glaciers flowing into the Larsen C ice shelf have begun to accelerate. Actually, it was glaciers flowing into Larsen B that began to accelerate before the shelf's collapse. Also, the first reference should have been to E. Rignot *et al. Geophys. Res. Lett.* **31**, L18401 (2004).

CORRECTION

The news story 'How to kill wild animals humanely for conservation' (*Nature* 543, 18–19; 2017) misstated the affiliation for Sara Dubois. She is at the British Columbia Society for the Prevention of Cruelty to Animals.