

News in focus

cases, death. (Although the disease was renamed mpox in 2022, the virus is still called monkeypox virus.) The virus persists in wild animals in several African countries, including the DRC, and occasionally spills over into people.

Unheeded warnings

The first large reported outbreak with human-to-human transmission occurred in 2017 in Nigeria and was caused by a strain called clade II, which is less virulent than clade I. The outbreak caused more than 200 confirmed and 500 suspected cases. At the time, researchers cautioned that the clade II strain might have adapted to spread through sexual contact.

Their warnings were not heeded; in 2022, a global outbreak driven, in part, by sexual contact prompted the World Health Organization (WHO) to declare it a public-health emergency. The outbreak, which is still ongoing, is caused by a clade II strain and has infected more than 95,000 people and killed more than 180.

Although mpox infections have waned globally since 2022, they have been trending upwards in the DRC: last year, the country reported more than 14,600 suspected infections and more than 650 deaths. In September, a new cluster of suspected clade I infections arose in the DRC's South Kivu province. This cluster is particularly concerning researchers because many infections have occurred in sex workers, suggesting that the virus has adapted to transmit readily through sexual contact.

This could lead to faster human-to-human spread, potentially with few symptoms, says Nicaise Ndemi, a virologist at the Africa Centres for Disease Control and Prevention who is based in Addis Ababa. "The DRC is surrounded by nine other countries – we're playing with fire here," he says.

Health officials are so concerned that representatives of the DRC and 11 nearby countries met last month to plan a response and to commit to stepping up virus surveillance. Only about 10% of the DRC's suspected mpox cases last year were tested, owing to limited testing capacity. Health officials "don't have a full picture of what's going on", Ndemi says.

Genetic analyses of the virus responsible for the outbreak uncovered mutations such as the absence of a large chunk of the virus's genome, which researchers have shown is a sign of adaptation (S. Monzón *et al. Nature Commun.* **15**, 3059; 2024). This has led the study's authors to give a new name to the strain circulating in the province: clade Ib.

Vaccines and treatment needed

Making matters more fraught, South Kivu borders Rwanda and Burundi and is grappling with "conflict, displacement, food insecurity and challenges in providing adequate humanitarian assistance", which "might represent fertile ground for further spread of mpox", the WHO

warned last year.

In 2022, many wealthy countries offered vaccines against smallpox, which also protect against mpox, to individuals at high risk of contracting the disease. But few vaccine doses have

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reached African countries, where the disease's toll has historically been highest.

While the DRC weighs up regulatory approval for these vaccines, the United States has committed to providing the DRC with enough doses to inoculate 25,000 people, and Japan has said it will also provide vaccines, says Rosamund Lewis, technical lead for mpox at the WHO. But a vaccination drive in the DRC would require

hundreds of thousands – if not millions – of doses to inoculate every individual at high risk of infection, she says.

It's not clear how much protection these vaccines will provide against clade I mpox, but Andrea McCollum, a poxvirus epidemiologist at the US Centers for Disease Control and Prevention in Atlanta, Georgia, says that data from animal studies are promising.

Researchers are also conducting a trial in the DRC of tecovirimat, an antiviral drug that is thought to be effective against the monkeypox virus. Results are expected in the next year, McCollum says.

The WHO and the CDC have helped to procure equipment that will allow for more rapid diagnosis of the disease in the DRC, especially in rural areas, Lewis says. She adds that the rapid mobilization of African health officials gives her hope that the outbreak can be controlled before the clade Ib strain starts spreading elsewhere.

ARE BEES SENTIENT? ANIMAL CONSCIOUSNESS NEEDS A RETHINK

Scientists declare that elements of consciousness are 'a realistic possibility' in reptiles, insects and molluscs.

By Mariana Lenharo

Crows, chimps and elephants: these and many other birds and mammals behave in ways that suggest they might be conscious. And the list does not end with vertebrates. Researchers are expanding their investigations of consciousness to a wider range of animals, including octopuses and even bees and flies.

Armed with such research, a coalition of scientists is calling for a rethink in the animal-human relationship. If there's "a realistic possibility" of "conscious experience in an animal, it is irresponsible to ignore that possibility in decisions affecting that animal", the researchers write in a document they call The New York Declaration on Animal Consciousness. Issued on 19 April during a meeting in New York City, the declaration also says that there is a "realistic possibility of conscious experience" in reptiles, fish, insects and other animals that have not always been considered to have inner lives, and "strong scientific support" for aspects of consciousness in birds and mammals.

As the evidence has accumulated, scientists have been "taking the topic seriously, not dismissing it out of hand as a crazy idea

in the way they might have in the past", says Jonathan Birch, a philosopher at the London School of Economics and Political Science and one of the authors of the declaration.

The document, which had around 40 signatories on day it was published, doesn't state that there are definitive answers about which species are conscious. "What it says, is there is sufficient evidence out there such that there's a realistic possibility of some kinds of conscious experiences in species even quite distinct from humans," says Anil Seth, director of the Centre for Consciousness Science at the University of Sussex near Brighton, UK, and one of the signatories. The authors hope that others will sign the declaration and that it will stimulate both more research into animal consciousness and more funding for the field.

Blurry line

The definition of consciousness is complex, but the group focuses on an aspect of consciousness called sentience, often defined as the capacity to have subjective experiences, says Birch. For an animal, such experiences would include smelling, tasting, hearing or touching the world around itself, as well as feeling fear, pleasure or pain – in essence, what it

is like to be that animal. But subjective experience does not require the capacity to think about one's experiences.

Non-human animals cannot use words to communicate their inner states. To assess consciousness in these animals, scientists often rely on indirect evidence, looking for certain behaviours that are associated with conscious experiences, Birch says.

One classic experiment is the mirror test, which investigates an animal's ability to recognize itself in a mirror. In this experiment, scientists apply a sticker or other visual mark to an animal's body and place the animal in front of a mirror. Some animals – including chimpanzees (*Pan troglodytes*)¹, Asian elephants (*Elephas maximus*)² and cleaner fishes (*Labroides dimidiatus*)³ – exhibit curiosity about the mark and even try to remove it. This behaviour suggests the possibility of self-awareness, which might be a sign of consciousness.

In an experiment with crows (*Corvus corone*)⁴, the birds were trained to make a specific head gesture whenever they saw a coloured square on a screen, a task they carried out with high accuracy. While the birds performed the task, scientists measured the activity in a region of their brain associated with high-level cognition. The birds' brain activity correlated with what the birds were reporting, not with what they were actually shown. This suggests that they were aware of what they were perceiving, another potential marker of consciousness.

Invertebrate inner lives?

Another experiment showed that a species of octopus (*Octopus bocki*)⁵, when picking between two chambers, avoided one where they had previously received a painful stimulus in favour of one where they were given



Octopuses avoid pain, which some scientists take as a sign of consciousness.

an anaesthetic. This suggests that they experience and actively avoid pain, which some researchers think indicates conscious experience.

Investigations of fruit flies (*Drosophila melanogaster*) show that they engage in both deep sleep and 'active sleep', in which their brain activity is the same as when they're awake⁶. "This is perhaps similar to what we call rapid eye movement sleep in humans, which is when we have our most vivid dreams, which we interpret as conscious experiences," says Bruno van Swinderen, a biologist at the University of Queensland in Brisbane, Australia, who studies fruit flies' behaviour and who also signed the declaration.

Some suggest that dreams are key components of having conscious, he notes. If flies and other invertebrates have active sleep, "then maybe this is as good a clue as any that they are perhaps conscious".

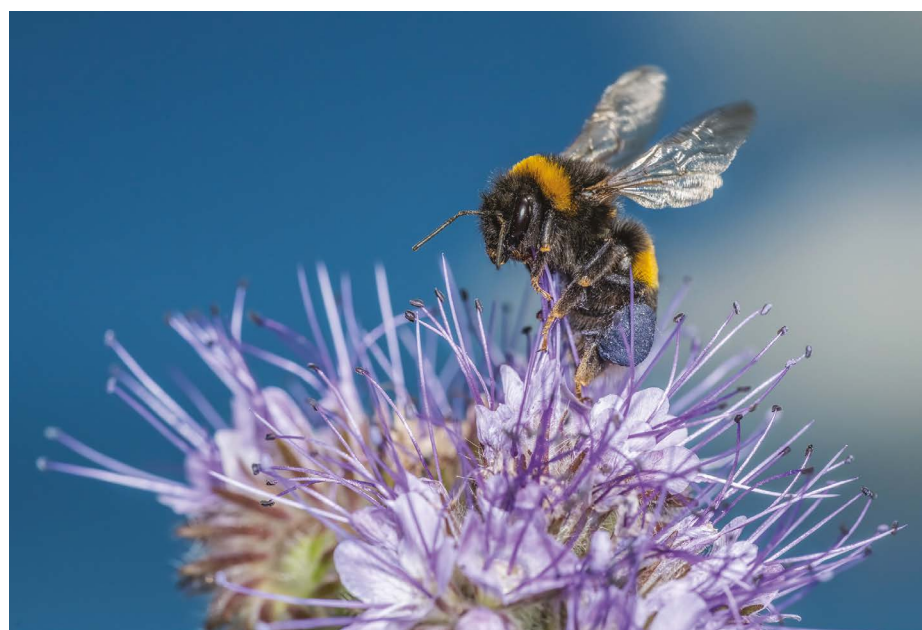
Animal minds

Other researchers are more sceptical about the evidence on animal consciousness. "I don't think there is basically any decisive evidence so far," says Hakwan Lau, a neuroscientist at the Riken Center for Brain Science in Wako, Japan.

Lau acknowledges that there is a growing body of work showing sophisticated perceptual behaviour in animals, but he contends that that does not necessarily indicate consciousness. In humans, for example, there is both conscious and unconscious perception. The challenge is to develop methods that can reliably distinguish between the two in non-humans.

Seth responds that, even in the absence of definitive answers, the declaration might still have a positive influence in shaping policies relating to animal ethics and welfare.

For van Swinderen, the time is right to consider whether most animals might be conscious. "We are experiencing an artificial-intelligence revolution where similar questions are being asked about machines. So it behoves us to ask if and how this adaptive quality of the brain might have evolved in nature."



Bees show forms of consciousness, suggests a scientific statement.

1. Gallup Jr, G. G. *Science* **167**, 86–87 (1970).
2. Plotnik, J. M., de Waal, F. B. M. & Reiss, D. *Proc. Natl Acad. Sci. USA* **103**, 17053–17057 (2006).
3. Kohda, M. et al. *Proc. Natl Acad. Sci. USA* **120**, e2208420120 (2023).
4. Nieder, A., Wagener, L. & Rinnert, P. *Science* **369**, 1626–1629 (2020).
5. Crook, R. J. *iScience* **24**, 102229 (2021).
6. Anthoney, N. et al. *eLife* **12**, RP88198 (2023).