

A mole in hand...

A strange Australian mole has eluded scientific study for more than a century. Now biologists are teaming up with Aboriginal trackers to unearth the secrets of the itjaritjari. Carina Dennis checks on their progress.

A thin layer of red dust has settled across Joe Benshemesh's desk, coating boxes brimming with field instruments, wires, maps and notebooks. He has just returned from one of the most remote corners of Australia's outback. Still picking the dirt out from under his fingernails, he talks excitedly about the trip — his enthusiasm all the more remarkable given that he has seen the object of his studies only a few times.

Benshemesh, an ecologist at the Northern Territory Government's Biodiversity Conservation Division in Alice Springs, is studying the elusive sand-dwelling marsupial mole of Australia. The animal spends most of its life underground, rarely surfacing, and until now has been classified as 'too hard' to investigate by scientists. Even the local Aboriginal people — who have lived alongside the mole for thousands of years — know relatively little about its secretive life.

But they do know a lot about desert tracking. Now, in an unusual collaboration between scientists and an Aboriginal group, Benshemesh and his colleagues have combined ancient hunting methods with modern technology to learn more than ever before about this mysterious animal.

First recorded by Westerners in the late 1800s, the mole, often referred to by its Aboriginal name itjaritjari, caused a stir in zoological circles with its unusual features. At no more than 14 centimetres long, its tubular body fits into the palm of the hand. It lacks eyes and has only tiny holes for ears. And its short, cream-coloured fur, spade-like front claws and a backwards-facing pouch give it an unearthly appearance.

Despite the existence of a number of



Caught! An Aboriginal tracker proudly displays a rare find — the elusive itjaritjari.

pickled specimens in museums around the world, little is known about this creature. This is because the itjaritjari rarely surfaces, making observation in the wild virtually impossible. All specimens caught live have died within weeks in captivity for reasons that remain unclear.

Benshemesh's first job in finding new moles to study was to work out where to dig. For this he turned to the Aboriginal people of the Anangu Pitjantjatjara lands in central Australia. He sought from them both permission to track the mole, which lives mainly on their land, and help in finding the animal's hide-outs. Although the Aboriginals rarely track the mole for food — given that it's hard to catch and not much of a meal — they are familiar with the surface signs of all the local animals, including the mole.

Carved in sand

Benshemesh's key collaborator on the project is Robin Kankanpakantja, an Aboriginal elder who lives at Walalkara, some 500 kilometres southwest of Alice Springs. Kankanpakantja, who says he is well into his seventies, shares Benshemesh's enthusiasm about the mole, because it features in the

collection of Aboriginal spiritual beliefs known as *Tjukurpa* — sometimes translated as 'dreaming' — which still guides daily life for many Aboriginal people.

Although the two have become friends, the linguistic divide has been a challenge. "Our conversations can take a while — you need patience," says Benshemesh. The usual procedure for exchanging critical information about the mole begins with Benshemesh listening to Kankanpakantja, who speaks a mixture of English and his native tongue, Yankunytjatjara. Benshemesh then repeats this back to him in English, and Kankanpakantja corrects him as necessary.

In 1998, with Kankanpakantja's guidance, Benshemesh began digging trenches in spots that showed evidence of mole inhabitation. Now, six years later, Benshemesh has learnt to recognize some signs of the mole, such as their tracks in the sand, but he has yet to develop a knack for consistently distinguishing the more subtle signs, such as small rises where tunnels have come near the surface. Yet the Aboriginal elders, after a lifetime of reading tracks in the bush, spot these almost intuitively.

One of the first discoveries to emerge from



Robin Kankanpakantja (left) has helped researchers to find where to dig for the marsupial mole.

J. BENSHEMESH

this joint search was that the itjaritjari produces stunning labyrinths of tunnels. This immediately dispelled one myth about the creatures: that their behaviour is like that of desert golden moles (*Chrysochloridae*) of southern Africa, which they strongly resemble. Desert golden moles are known as sand-swimmers because they produce no tunnels. The itjaritjari is clearly different. "If it was a sand-swimmer, you'd expect the sand to collapse behind it, leaving no trace of its path," says Benshemesh.

Blind vision

But more challenging questions that require modern gadgetry remain. Critically, how many of these creatures are there? To find out, Benshemesh set out 30 geophones, sensitive microphones that pick up vibrations in the sand, in a grid pattern over roughly a quarter of a hectare. He plans to eavesdrop on the moles' underground scratchings and use the data to estimate their speed and direction. With enough readings, it should be possible to estimate the size of the mole population in the region by comparing the rate at which moles tunnel with the extent of the tunnels determined by trenching.

Benshemesh would also like to learn more about the extent of the itjaritjari's distribution. To this end he is training Aboriginal people in the use of CyberTracker, a device originally developed in South Africa for ecological studies assisted by Kalahari bushmen. The hand-held unit allows the user to enter electronic notes while a satellite receiver monitors the user's location.

This approach alone could never completely scour Australia's vast network of sand ridges — stabilized dunes that cover some 1.2 million square kilometres. So Benshemesh has narrowed the search with the

help of geologist Bretan Clifford, an independent consultant who until recently worked at the Alice Springs base. Clifford has created a picture of the connections between individual sand ridges using digital maps derived from aerial photographs.

Assuming that an itjaritjari won't travel much farther than 250 metres on the surface because of its vulnerability to predators, Clifford has been able to break the ridges into six interconnected blocks that the mole is unlikely to move between. This allows information on the number and distribution of moles gleaned from one region to be extrapolated to the whole block. "It massively increases the efficiency of searching for the mole," says Clifford.

Finding more moles will be important to understanding its natural history. So far, only two species of itjaritjari have been described

— *Notoryctes typhlops* and *N. caurinus* — based on details of their appearance. DNA studies could shed more light on their diversity, but researchers have had to rely on preserved museum specimens, the DNA from which has usually degraded.

A recent breakthrough came when researchers discovered that they could get good DNA samples from the droppings of foxes, cats and dingos, all of which eat the moles (R. Paltridge *Australian Mammalogy* 20, 427–429; 1998). "The amount of marsupial mole that comes out of these dingo turds is huge and makes it really easy to study," says Steve Donnellan, a geneticist at the South Australian Museum in Adelaide.

From his studies of the droppings, Donnellan has preliminary evidence that there may be more than two species. "There is a hint of genetic variation there but it's not yet clear whether it's a different species or variation within species," he says. So far he has

"The amount of marsupial mole that comes out of dingo turds is huge and makes its DNA really easy to study."

— Steve Donnellan

looked only at differences in mitochondria, DNA-bearing compartments within the cells. He is now looking for a similar pattern of variation in genes in the cells' nuclei, which would suggest wider divergence and possibly speciation.

At the moment, if one is lucky enough to find an uneaten mole, recording its movements requires endurance. Only in the winter are daytime temperatures cool enough for fieldwork, but that means shivering through some very frosty desert nights. On one occasion, Benshemesh's team, many of them volunteers from the environmental group Earthwatch, managed to catch a mole on the surface. They released it and began recording from a geophone as it dived underground and started tunnelling. They took shifts over three days and nights to monitor its faint scratchings, producing one of the few existing recordings of itjaritjari.

Scratching around

Now that the geophones are in place, Benshemesh has plans to automate the recording and data analysis. For help, he turned to Don Simkins, a signal-processing expert with Zeta Associates, a company doing contract work for the US military base at Pine Gap in central Australia. The key is to figure out how to spot the sound of a mole in the din of background noise made by wind and other animals, and then to track its movement.

The more sophisticated the geophone monitoring becomes, the better it will be for eavesdropping on other mole activities, such as sex. "I'm really looking forward to that," says Benshemesh. He'd like to know not only how boy meets girl underground, but also how the young are reared. So far, he hasn't found any holes small enough to have been tunnelled by little ones. This means that the young either stay behind in a nest until they are grown or tag along behind their parents as they tunnel.

Benshemesh is impatient to monitor the animals underground because he suspects that those found on the surface are not behaving normally, and may even be sick. It's a risky place for a blind animal to be with foxes and dingos around, and they have no good reason to be there, he says. "My suspicion is that these are animals in trouble," says Benshemesh.

There is also a sense of urgency for the Aboriginal people who share the mole's land. Time is running out for the generation of trackers Benshemesh has worked with, and much of their knowledge is being lost. Western influence has left many of the younger generation feeling disconnected from their land and traditions. Benshemesh hopes that collaborative research on the mole will help to preserve indigenous culture. "It'll be a sad day when white fellas are teaching the Aboriginal people about tracking the mole," he says. ■

Carina Dennis is *Nature's* Australasian correspondent.

J. BENSHEMESH