The CSI Death Dogs: Sniffing Out the Truth Behind the Crime-Scene Canines

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At the former children's home at Haut de la Garenne in Jersey, a sensational discovery was made in February; a fragment of what might have been human bone. It was unearthed by a dog trained to detect human remains.

Forensic experts have pored over it, but the fragment is very small, and with no DNA to go on, it has been difficult to establish whether it is animal or vegetable. On its identity rests not only the question of whether an abuse inquiry is now a murder inquiry, but also the credibility of the policeman's best friend, the sniffer dog.

Dogs' sense of smell is far more acute than that of humans – the nose of a German shepherd contains about 200 million olfactory cells, while a human nose has about 20 million. This superior canine sense has been put to use in criminal investigations for centuries. Dogs used in law enforcement today have an impressive range of skills, from sniffing out explosives to locating earthquake survivors – as in recent weeks in China – and matching criminal suspects to their scent trails – but the speciality in the spotlight in Jersey is the human cadaver dog.

The case has led to some criticism of the faith that police place in these dogs. Nobody really knows how they do it. The dogs don't always get it right, yet the police regard them as a valuable search-tool, to be used alongside other, more scientific techniques such as ground-penetrating radar and aerial photography.

One of the questions surrounding human cadaver dogs is how soon after death they can recognise a corpse, and how long a "fresh" corpse must remain in one place for a dog to detect that it has been there. In a study published last year, the forensic pathologist Lars Oesterhelweg, then at the University of Bern in Switzerland, and colleagues tested the ability of three Hamburg State Police cadaver dogs to pick out – of a line-up of six new carpet squares – the one that had been exposed for no more than 10 minutes to a recently deceased person.

Several squares had been placed beneath a clothed corpse within three hours of death, when some organs and many cells of the human body are still functioning. Over the next month, the dogs did hundreds of trials in which they signalled the contaminated square with 98 per cent accuracy, falling to 94 per cent when the square had been in contact with the corpse for only two minutes. The research concluded that cadaver dogs were an "outstanding tool" for crime-scene investigation.

But how good are dogs at detecting a skeleton from which all the flesh has fallen away? The anthropologist Keith Jacobi of the University of Alabama has investigated this at a police-dog training facility, where human remains ranging from fresh to skeletonised have been buried (the remains were bequeathed by donors).

In one study involving four dogs and their handlers, Jacobi says the dogs were able to detect remains at all stages of decomposition. Performance varied between dogs, but some could locate skeletonised remains buried in an area of 300ft by 150ft. "The few single human vertebrae I used in the study were well over 25 years old, and dry bone," Jacobi says. "This made the discovery of one of these vertebrae, which we buried in dense woods 2ft deep, by a cadaver dog pretty remarkable."

A trained human cadaver dog will not signal a living person or an animal (except pigs), but it will signal a recently deceased, putrefying or skeletonised human corpse. That suggests that the "bouquet of death" is discernible, but attempts to identify it have so far failed. Two of the by-products of decomposition, putrescine and cadaverine, have been bottled and are commercially available as dog training aids. But they are also present in all decaying organic material, and in human saliva.

A human cadaver dog's detection skills depend greatly on its training, and the problem is that human remains are hard to come by. Trainers often use a combination of available "pseudoscents", and pigs. The problem with pseudoscents, says Mick Swindells, a retired police handler who works as a freelance trainer and handler in Blackpool, is that they represent a "snapshot" of death. As decomposition proceeds, the chemistry of the corpse evolves, causing its odour to change. "I'm trying to train a dog to find the whole video, not just a snapshot," he says. Pigs decompose in similarly to humans, and when buried they disturb the ground in a similar way.

A number of research groups are searching for a more precise chemical signature of death. One approach is the "head space" technique perfumers use to identify the components of a scent in order to recreate it in the lab. In this case, small amounts of gas are collected from samples of dead flesh, or from soil in which remains have been buried. The volatile organic compounds given off by the dead flesh are analysed, using a method called gas chromatography-mass spectrometry, to identify their components.

At Cranfield University in Shrivenham, Wiltshire, the forensic anthropologist Anna Williams and student Helena Rogers are involved in one such project, using pig carcasses. Their goal is to determine if there is an association between the stage of decomposition, the odour profile and the accuracy of the cadaver dogs' detection. Synthetic versions of the different odours could also be used in training.

Belgian researchers have gone further. Using the same "head space" technique, the chemist Bart Smedts of the Royal Military Academy in Brussels and Joan de Winne of the Federal Police identified one compound, dimethyl sulphide, that is a general marker of putrefaction across a range of species, including human. Dogs trained to detect human remains will signal to dimethyl sulphide. The researchers claim to have identified other, species-specific combinations of chemicals.

De Winne says a portable "head space" device could be used instead of, or as well as, a cadaver dog to detect dimethyl sulphide. The researchers are also investigating other "biosensors", including turkey vultures and parasitic wasps. "Each biosensor has its advantages and disadvantages," de Winne says. "Vultures can cover a large area. Parasitic wasps can be trained in half an hour, but they live for only a few days."

Mark Harrison, national search adviser for the UK National Policing Improvement Agency in Wyboston, Bedfordshire, is all for developing new search tools. He has advised police and rescue services on search strategy in major incidents, including the Asian tsunami of 2004. In the aftermath of that disaster, he used computers to model wave action to help guide the dogs and their handlers towards the "capture points" where victims were likely to have been washed up. But, he says: "If you ask me, 'Will a machine replace dogs?' I would say no."

Swindells says: "The best thing about using a dog to detect cadavers, as opposed to machines, is that dogs have the ability to think. But that's also the worst thing about using dogs." This means that cadaver dogs appear to have sufficient intelligence to recognise a corpse across a range of environmental conditions. However, they can also be distracted, for example by methane produced naturally in a peat bog (corpses also produce methane).

One indisputable advantage dogs have over machines is that they can quickly narrow down a search when a large area has to be covered. Adee Schoon of Leiden University, a scientific adviser to the canine department of the Netherlands National Police Agency, sums up the attitude of many who work with human cadaver dogs: "We use dogs as intelligent samplers, to tell us where to look further."

So, although death dogs may not always get it right, their discoveries can make the difference between solving a crime and leaving dark secrets buried for ever.

Dog nose best

In 2000, freelance dog handler Mick Swindells and his Border collie Shep, a trained human cadaver dog, were called to a 15-acre field near Nottingham to help locate the suspected grave of a murder victim. Shep signalled in one spot and the surrounding area was quickly dug, but nothing was found. Later that day, police returned with an informant, who identified the grave. Shep had been out by a metre.

It transpired that, in digging the grave, the murderer had put his spade through a field drain, causing volatile compounds from the decomposing cadaver to enter the drain. About a metre downhill of the cadaver, the drain was broken, preventing those compounds from dispersing further. The drain had, in effect, separated the body from its scent, and Shep had signalled the dislodged source of that scent – the breakage in the drain.

On another occasion, Swindells and one of his dogs were searching a house when the dog signalled. A cache of bones was found beneath the floorboards at the spot – but they were later identified as pig. Pig carcasses are used in training cadaver dogs. But why would anybody hide a dead pig? The dating of the bones gave a clue: they had probably been buried during the Second World War, when pork was rationed and penalties for dabbling in the black market were severe.

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