Stewie, a 6-year-old Australian shepherd, gives a "trained alert" to indicate that she has detected cancer, sitting, pawing at the sample she has identified and placing her nose up against it.

» A lab technician at the In Situ Foundation places a cancer sample among healthy controls in the scenting apparatus.

Each of these studies and others inspired a flurry of media attention and public enthusiasm, but researchers caution that a lot of work remains.

"There's definitely potential," says Peter Belafsky, M.D., Ph.D., a University of California at Davis professor working on a study using canines to detect head and neck cancers. "There are promising clinical studies. But we need more good science before we open a Pandora's box of excitement."

Not all studies of cancer-sniffing dogs have been successful, and experts need to figure out if that's due to the dogs' cancer-smelling ability, or some other factor that affected the results.

Belafsky and others point to many issues: Training methods for the dogs need to be standardized. Opinions differ on what kinds of samples — breath, urine, plasma, blood, tissue — yield the most accurate results. Studies must be designed so that dogs won't be tipped off by subtle signals from their handlers. Dogs' sense of smell is so sensitive that results can be thrown off by changing the kind of preservative used to treat samples, or by the smell of the person collecting them, or by the place in which they were collected, or even by the color of the Sharpie used to mark the sample.

Obtaining enough rigorously-collected samples — thousands to train a dog and at least hundreds for a peer-reviewed study — remains a challenge for researchers. Several studies in process, including Belafsky's at UC Davis, have stalled while waiting for enough appropriate samples. PennVet just received a large grant from the Kleburg Foundation and plans to use that to greatly expand its base of samples.

Then there's the question of what to do with this knowledge that dogs can smell cancer. Do you train an army of dogs to be deployed to hospitals? In part, the In Situ Foundation in the United States and Medical Detection Dogs in the United Kingdom are working toward that. Do you partner dogs with people at high risk of cancer recurrence, as some have suggested, in the hopes that the dog will alert more quickly than standard screens? Do you try to figure out exactly what VOCs prompt a dog to identify a cancer sample and then engineer a sensor or machine to detect those VOCs? Medical Detection Dogs and the U.K.'s National Health Service are conducting a study with that goal, as is a team at the University of Pennsylvania. Or do you somehow partner dogs with mechanical or imaging sensors, as others have suggested?