

## Key point:

- The only realistic solution to dog and cat overpopulation worldwide will be the development of nonsurgical female sterilization, the Holy Grail of veterinary medicine

Ultimately, there are only 4 options for feral domestic animals. Finding permanent homes (whether adopted directly off the street or via temporary housing in a shelter or rescue), permanent placement in shelters for the life of the animal, euthanasia, or allowing them to remain feral. Given that there are not enough homes nor permanent shelter space, and that the large humane organizations explicitly state that their goal is to end euthanasia done for nonmedical reasons, the last remaining option is to allow cats and dogs to remain feral. This, however, will not be an accepted answer by municipalities or wildlife agencies, so in effect humane organizations have a direct interest in suggesting that spay / neuter of free-roaming, unowned populations (TNR) will ultimately lead to the gradual removal of feral animals by non-euthanasia methods. Unfortunately, presenting an entirely impractical approach as scientifically valid and failing to mention the actual numbers required ultimately leads to more deaths.

Expressing this to financial contributors would be catastrophic, however, as they donate from the belief that their monies contribute to lower populations and thereby reduce euthanasia rates. Humane organizations thus not only have an emotional investment in promoting spay / neuter in order to avoid the only other current option of euthanasia, but also a large financial incentive to promote their work as effective. In fact, the development of a quick and easily administered nonsurgical spay method that could be given by the thousands daily by vets or even animal control agencies would remove the need for large stakeholder shelter organizations within a

decade, eliminating a multi-billion dollar set of organizations. Whether or not any financial motive exists on the part of board members from large organizations, the fact remains that these same agencies are the direct source of funding for the shelter medicine programs that publish the studies cited as "proof" of the effectiveness of spay / neuter.

Financial and human resources towards animal welfare are finite, and every dollar or hour spent on programs that do not actually reduce populations is time and money not available for research into effective long term solutions. Globally, there are simply not enough time and financial resources to achieve surgical contraception of >70% of stray and feral animals within two reproductive cycles and to continue each and every year thereafter for a decade until populations reach a zero endpoint, then to maintain active vigilance as owned animals slowly start to repopulate feral populations. The only way that reproductive sterilization of >70% of feral domestic animals will be achievable will be a nonsurgical method that can be administered at much higher daily rates by veterinary personnel or otherwise.

From the journal of Theriogenology, "Nonsurgical sterilization of free-roaming dogs has the potential to be more cost effective than surgical sterilization in reducing the size and impact of dog populations as many more animals can be treated compared with the numbers that can be neutered or spayed per unit time" (61). Given the ability to sterilize females using an injectable method and without the need for anesthesia or high levels of training, two people working together could treat hundreds of animals per day. Using an oral product, thousands of animals could be treated in a day, although it has been debated as to whether such an oral (or even injectable) product will ever see the light of day, considering the potential misuse in human populations. That said, research into the development of an oral or injectable contraceptive is supported by the American Veterinary Medical Association, the largest veterinary organization in the world (85).

With the advent of nonsurgical female contraceptive agents administered by simple injection similar to a vaccine, large populations of free-roaming animals could be treated rapidly. Given this

technology, the 70% or higher requirement for intact females to be "spayed" within a year's time could actually be met, even in large urban areas. Cultures with minimal general interest in animal welfare would likely welcome the approach given the short life span of free-roaming animals and the speed at which street animals would disappear without being immediately replaced by the next generations.

Ideally, a nonsurgical sterilizer would be cost effective for large population use, inhibit female reproduction and render animals infertile for 1 or more years, have "zero or acceptable side effects", and be stable and usable under normal field conditions (61). The importance of cost feasibility cannot be overstated considering that the vast majority of the world's domestic animals live in impoverished nations.

Within the developed western world, household pet owners might raise concern over long term side effects of any non-surgical spay agent. In a confined household where dogs and cats might live a decade or longer, this is understandable. But for most reservation dogs and cats, there is the more pressing immediate short term concern of death from multiple factors. Most animal welfare advocates would be willing to risk long term side effects in order to achieve population reduction and reduce high turnover rates with constant death. Additionally, "as population turnover of roaming dogs is fast because of high mortality rates, a fertility inhibitor that prevents reproduction for 2 to 3 years is likely to cover the lifespan of most animals" (61). Street animals simply don't live long enough to develop long term consequences.

The development of a safe, permanent injectable or oral form of contraception for dogs and cats has been pursued for decades on a relatively small scale but the promotion by the veterinary community that surgical TNR is effective has likely hindered research into these nonsurgical methods. As stated by researchers from the University of Florida, "the danger we see in TNR programs is that TNR may be seen as a viable solution to reducing feral cat populations, and that therefore less money and effort will go towards prevention of free-ranging cats"(34).

Not including the many small organizations involved in TNR in the US nor any local humane societies, a review of the most recent financial statements from just three of the larger national humane organizations involved in TNR advocacy list total combined assets of \$1.22 Billion (86, 87, 88). These organizations clearly do much more than TNR, but by way of comparison, the largest public group working towards nonsurgical methods of contraception had an average total annual revenue of \$264K for the two year span 2019-2020 (89). Some of this revenue was contributed by the larger humane organizations above, and in fact many of the individuals involved in the ongoing search for nonsurgical methods of contraception work for and with these large humane organizations and have authored many of the aforementioned studies. But, the fact remains that as a whole, the veterinary community and financial donors at large contribute exponentially more time and financial resources towards methods of population control that are not feasible on global scale, and these large humane organizations use surgical TNR programs in order to seek donations without disclosing the previously mentioned fact that their own researchers admit that "small programs don't reduce populations and result in more preventative death" (40).

Given the relative lack of interest by the billion dollar animal welfare industry in pursuit of nonsurgical spay agents, and in keeping with the development of nearly every modern technological breakthrough, it is highly likely that the advent of such a product will require a profit margin. Potential for profit fuels research and development, and thus it may be in the best long term interest for "nonprofits" to encourage pharmaceutical companies to create a product that when purchased by the hundreds of millions of doses annually could not only generate revenue but solve real world problems. A dose that costs less than a dollar to manufacture then sells to animal welfare groups for a dollar or two more could generate billions of dollars in profit but at the same time achieve 70% spay rates worldwide. Within 5 years, numbers of street animals would decrease to the point that the total overall expenditure would be significantly less than would be spent on ineffective solutions if donations are wasted at the current rates of spending.

The lack of open disclosure that, despite perceived benefits, conventional spay / neuter do not reduce free-roaming populations ultimately results in a continued cycle of euthanasia worldwide. In developing countries with vast urban landscapes containing large stray populations, veterinarians and small street-level animal rescue organizations continue to push for spaying and neutering as the answer to the myriad of problems that stem from overpopulation without understanding that no long term change actually occurs despite their well-intentioned efforts. Many of these places have stray dog and cat populations far beyond that anywhere in the developed world, and animal control agencies euthanize large numbers of animals annually using methods such as electrocution and strychnine poisoning. Continuing to promote surgical spay and neuter mantra as the answer does these animals a serious disservice, and ultimately this use of our resources prolongs the cycle of euthanasia. We cannot spay our way out of the global problem of pet overpopulation, and animals deserve better.