

# Companion Animals Symposium: Companion Animal Reproduction: To breed or not to breed?

**239 Canine and feline reproductive biology 101.** M. Kutzler,\*  
*Oregon State University, Corvallis.*

This lecture is designed to provide a primer on canine and feline reproduction for scientists unfamiliar with this topic as well as lay people. Domestic bitches are nonseasonally monoestrous. As a result of this unique reproductive physiology, bitches spontaneously ovulate only once or twice per year and ovulation can occur at any time of the year. Queens are induced ovulators, requiring external stimulation (such as natural breeding) to stimulate the ovulation of mature follicles. During the breeding season, queens exhibit estrous behavior every 2–3 wks unless ovulation occurs. However, the occurrence of estrus and ovulation are not repetitive, cyclic or predictable. In bitches, ovulation of primary oocytes occurs 36–50 h after the onset of the surge in luteinizing hormone (LH). Oocyte maturation (extrusion of the first polar body) is complete 2–3 d post-ovulation and sperm can penetrate the zona pellucida before extrusion of the first polar body. Queens ovulate secondary (mature) oocytes capable of fertilization immediately following ovulation. Fertilization (extrusion of the second polar body) occurs in the uterine tube. Embryos are present within the uterine tube 7 d past the onset of the LH surge and late morulas and early blastocysts enter the uterus 10 d past the onset of the LH surge. Prior to implantation, embryos float freely within the uterine lumen, nourished by “uterine milk” (histotroph). Embryo migration between uterine horns does occur and blastocysts space themselves out evenly between horns until 16 d after the onset of the LH surge. Embryonic implantation occurs 22 d after the onset of the LH surge. Implantation sites can be observed ultrasonographically at this time. The bitch and queen have an endotheliochorial, zonary (circumferential), modified deciduate placenta. The continuous availability of ovarian progesterone is required for the initiation and maintenance of pregnancy in both species, such that ovariectomy at any time will result in resorption or abortion. No placental or embryonic luteotrophic secretions that have been demonstrated in the bitch or the queen. However, relaxin is only detectable during pregnancy and is the only specific pregnancy-associated protein in dogs and cats.

**Key Words:** ovulation, pregnancy, placentation

**240 Companion animal reproduction and nutrition 101.** D. Greco,\*  
*Nestle Purina Petcare.*

This review covers the use of common nutritional supplements for the bitch and puppies. Basic nutrients such as fat, protein, minerals, vitamins, and essential fatty acid supplementation will be discussed. Newer supplements such as probiotics for stimulation of the immune system of the bitch and puppy and use for the non-pharmaceutical treatment of weaning diarrhea will also be outlined.

**241 Companion animal population control: Past, present and future.** S. Zawistowski,\*  
*The American Society for the Prevention of Cruelty to Animals, New York, NY.*

The euthanasia of pets in US animal shelters likely peaked at an estimated 20 million per year around 1970. It was then that the first major programs appeared to promote and subsidize sterilization of dogs and

cats. The relentless efforts of shelter groups in the past 40 years have helped to reduce the euthanasia figure to about 4 million pets per year. This progress has been the result of broad based public education programs and substantial advances in the methods of surgical sterilization. Maintaining this success, and making further progress will likely require the development of non-surgical contraceptives and sterilants that do not call for the substantial infrastructure investments needed for high volume, high quality spay/neuter programs. Current research on non-surgical approaches employ cutting edge approaches in cell, molecular and neuroendocrine biology.

**Key Words:** companion animal population, spay/neuter, non-surgical sterilization

**242 The role of the domestic cat in endangered species conservation.** J. Herrick,\*  
*National Foundation for Fertility Research, Lone Tree, CO.*

Domestic cats are highly prolific breeders, so there has been little demand to study reproduction or develop assisted reproductive technologies (ARTs) in this species. As a result, surprisingly little is known about feline reproduction, despite the widespread popularity of cats as pets. However, most of the other 36 species of cats in the world are threatened with extinction. An improved understanding of feline reproduction would greatly benefit conservation efforts and population management for these endangered species. Since nondomestic cats are poor research subjects due to their limited availability and dangerous nature, the domestic cat has become an important model species for reproductive studies. Research in domestic cats has led to the development of techniques for noninvasive hormone monitoring and electroejaculation that have facilitated studies of estrous cycle dynamics and sperm physiology in nondomestic cats. Similarly, protocols for artificial insemination, in vitro fertilization, and embryo transfer developed in domestic cats have been used successfully in some nondomestic cat species. These ARTs could play a valuable role in conservation programs, but current protocols are inefficient and successful offspring production is sporadic. One of the many areas in need of additional research is the culture environment used for feline embryos following in vitro fertilization. During the first few days after fertilization, the embryo is extremely sensitive to its environment (the fluids of the reproductive tract or synthetic culture media). Even brief exposure to sub-optimal conditions during this time can have dramatic effects on embryonic and fetal viability. By developing a culture medium specific to the needs of the feline embryo, we have been able to greatly improve the success of in vitro fertilization in domestic cats, as well as several species of nondomestic cats. However, embryonic development in vitro is still compromised compared with development in vivo. Specifically, the feline embryo undergoes rapid cell division and appears to have unique nutritional requirements to support this growth that are not being met with current media formulations. Research to develop more appropriate culture media and increase the viability of cultured embryos will continue to rely heavily on the domestic cat, as will all research to improve the efficiency of ARTs. The future existence of endangered cats could very well depend on a better understanding of reproductive physiology in their domestic cousin.

**Key Words:** feline, assisted reproductive technologies, conservation

**243 Population control in wildlife: Lessons learned.** J. F. Kirkpatrick,\* *Science and Conservation Center, Billings, MT.*

The management of certain wildlife populations by means of fertility control has become widely accepted and is now commonly used in species such as wild horses, urban deer, African elephants, bison, and >85 species of captive exotic animals in zoos, worldwide. The most commonly used contraceptive agent is a porcine zona pellucida vaccine (PZP), which operates entirely outside the cascade of reproductive endocrine events. The characteristics of this vaccine come closer to the ideal for use in wildlife than any other form of contraception and include (1) efficacy of at least 90%, (2) remote delivery, (3) reversibility, (4) safe for use in pregnant animals, (5) minimal effects on behavior, (6) no debilitating side effects, (7) inability to pass through the food chain, and (8) low cost. Despite major scientific strides in achieving these goals and demonstrating success in the field, significant opposition remains. This opposition exists in the form of cultural and social biases, economic concerns, agency inertia and political pandering. Regardless of whether the development of this technology is aimed at wildlife or companion animals, involved scientists must understand that unless they are willing to address the points of opposition, as well as regulatory hurdles, much of their work and the resources expended can come to naught.

**Key Words:** population control, companion animals, wildlife

**244 Obesity is associated with adverse cardiovascular outcomes and insulin resistance in dogs.** J. L. Adolphe,\* T. I. Silver, M. D. Drew, and L. P. Weber, *University of Saskatchewan, Saskatoon, SK, Canada.*

Obesity and cardiovascular disease are strongly linked in humans, but this association is less clear in dogs. The purpose of this study was to

evaluate the effects of obesity on cardiac structure and function as well as insulin resistance in dogs. Cardiovascular variables were measured and oral glucose tolerance tests were performed before and after weight gain in 9 beagles. At baseline, dogs were fed a commercial diet in measured amounts to maintain an ideal body weight. Subsequently, for 12 weeks the dogs were allowed free access to the diet to allow weight gain. Echocardiography was used to analyze left ventricular function. Blood pressure was measured by high-definition oscillometry. Serum glucose and insulin were measured before and at specific time points after an oral glucose challenge to determine glucose tolerance and insulin sensitivity. CT (CT) was used to quantify total and visceral fat accumulation in the dogs in the obese state. Body weight increased from  $9.8 \pm 0.6$  kg at baseline to  $12.1 \pm 0.7$  kg ( $123 \pm 3\%$  of ideal body weight) after ad libitum feeding. Systolic left ventricular free wall thickness, heart rate, area under the glucose response curve and peak glucose significantly increased in the obese state compared with the lean state ( $P < 0.05$ ). Systolic free wall thickness was positively correlated with total fat ( $r = 0.7$ ,  $P = 0.02$ ) and visceral fat ( $r = 0.7$ ,  $P = 0.03$ ). Area under the insulin response curve was associated with visceral fat ( $r = 0.8$ ,  $P = 0.03$ ). Increased systolic free wall thickness, coupled with elevated heart rate, in dogs likely reflects hyperdynamic cardiac function which may have negative long-term cardiovascular consequences. Thus, this study supports the hypothesis that visceral fat is linked to detrimental changes in cardiac function and insulin sensitivity in obesity. These results are particularly remarkable considering that the dogs were obese for only 12 weeks.

**Key Words:** obesity, dogs, insulin resistance