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Improving Calving Intervals With Prostaglandin

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Pennsylvania dairy farmers lose an estimated \$90 million each year due to prolonged calving intervals in their cows. In registered herds, the average calving interval is estimated at 13.5 months. However, only half of the state's dairy cows are registered and the calving interval for all dairy cows in Pennsylvania probably exceeds 14 months. There is general agreement that the optimum calving interval for production efficiency is 12 months and that \$2 are lost for every day over this period. The longer calving interval is due primarily to poor heat detection and low first service conception rate. Studies have shown that heat detection and first service conception rates are both lower than 50 percent.

Researchers at the University of Pennsylvania School of Veterinary Medicine are studying whether treatment of postpartum cows with prostaglandin F2 alpha at regular intervals can improve heat detection, shorten the calving-conception interval, and whether such treatment will have a beneficial effect on fertility.

"Prostaglandin F2 alpha is a naturally occurring hormone," said Dr. Charles Love, one of the investigators. "It has no side effects on the animal and is metabolized rapidly, within 60 to 90 minutes after injection." The prostaglandin acts upon the corpus luteum, a gland which develops once a follicle has released the ovum. The corpus luteum produces mainly progesterone, a hormone needed to maintain pregnancy. If the animal has not conceived, the corpus luteum will regress naturally over a period of

time. Prostaglandin causes the corpus luteum to regress quickly and the cow will come into heat again much sooner. By injecting a postpartum cow at regular intervals with prostaglandin, the period between heat cycles can be shortened, theoretically increasing the number of cycles prior to breeding.

"Studies have shown that conception rate goes up the more estrus periods a cow experiences prior to breeding," said Dr. Love. "By injecting the hormone at regular intervals we can create two or three short estrus cycles before the cow is serviced."

Penn's researchers are studying a herd of 400 dairy cows at a near-by farm. The herd has been divided into two groups. One group is injected with prostaglandin F2 alpha at days 22, 36, and 49 postpartum. The control group is injected with a saline solution on days 22 and 36 postpartum. On day 49, these cows receive a prostaglandin F2 alpha injection. All cows are examined rectally and tested for milk progesterone on days 22, 36, and 49 -prior to the injection.

The milk progesterone level can provide an indication of the stage of the heat cycle. If the animal is out of heat about five days, the progesterone level will be high. The level will also be high if the cow has luteal cysts. The value will be low if the animal is not cycling, if it is just prior to ovulation, or when it has follicular cysts. These three conditions can often be differentiated through rectal examination.

Dr. Love explained that a regimen of prostaglandin injections postpartum could enable a

farmer to somewhat coordinate heat cycles within a herd. "Cows are only in heat for 12 to 18 hours and the biggest problem is to know when to breed. If more than one cow is in heat at one time the animals will exhibit mating behavior, such as mounting each other. This can be observed. When interaction occurs, the farmer knows that the animal is ready to breed."

The researchers also hope to ascertain whether the injections reduce the rate of uterine infections. "It is known that prostaglandin causes contractions which help evacuate the uterus," said Dr. Love. "This may help to remove any postpartum debris and thus reduce the chance of uterine infection."

The two-year study, funded by the Pennsylvania Department of Agriculture, should provide some answers to the calving interval problem. If prostaglandin F2 alpha injections shorten this period, then farmers everywhere can take advantage of this technique. The drug is already used in cattle for other purposes and it is inexpensive and easy to administer. The Penn researchers hope to have some definitive results at the end of the study.

Dr. Love is a graduate of the University of Missouri School of Veterinary Medicine. He came to Penn in 1985 as a resident and in 1987 was appointed lecturer in reproduction. The co-investigators are Dr. Grant S. Frazer, Dr. J. D. Ferguson and Dr. Elaine D. Watson.

Hookworm Disease Workshop

A workshop entitled "Hookworm Disease: Current Status and New Directions" was recently held at the Rockefeller Foundation Study and Conference Center in Bellagio, Italy. The workshop, which celebrated the 75th anniversary of the first international venture by the Rockefeller Foundation in hookworm control, was jointly organized by Dr. K.S. Warren (Rockefeller Foundation) and Dr. Gerhard A. Schad, professor of parasitology at the School. Dr. Schad's involvement in this workshop was in recognition of his unquestioned status as the "foremost authority in the United States on hookworms and hookworm infection."

Hookworms are nematodes and there are two important species that parasitize the human intestine: *Ancylostoma duodenale* and *Necator americanus*. The parasite is characteristic of rural areas in tropical



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and subtropical regions. The infective larvae are typically found in the soil around defecation sites and enter the host either by direct penetration of bare skin (both species) or by accidental ingestion (*Ancylostoma* only). The adult worms are blood feeders and prolonged infections with large numbers of parasites lead to iron deficiency anaemia, malabsorption and a loss of protein. The infection in children may lead to a profound impairment in physical and cognitive development. Although *N. americanus* originates from Africa, it was first described in the southern states of the USA, and it was here that the Rockefeller Foundation first became involved with hookworm disease and plans for "mitigating its evils." In subsequent years, the Foundation broadened its efforts to encompass other countries, particularly those under the jurisdiction of the old British Colonial Office. However, despite these early intensive attempts at control, hookworm is still a significant public health problem in many parts of the world. In the endemic areas of China, for example, it was recently found that between 30 percent and 50 percent of people tested were infected with one or both species of hookworm.

The participants of the Bellagio workshop listed a number of recent advances in our knowledge of hookworm disease that had proved particularly useful in our efforts to control the infection. Dr. Schad's research figured prominently in that list. His epidemiological studies of hookworm infection in India are seminal works. They provided the first evidence that *A. duodenale* may cease development in its human host for several months at a time. The occurrence of arrested development in *A. duodenale*

but not *N. americanus* explains perplexing differences between the population biology of the two species and has significant implications for the organization of control programs since arrested larvae are notoriously difficult to kill using conventional anthelmintic drugs. Dr. Schad's work also provided a dramatic experimental demonstration that some individuals are consistently more predisposed to infection with hookworms than others. This gave renewed impetus to the old idea of selective chemotherapy as a cost effective control strategy and prompted others to conduct similar studies on other gastrointestinal nematode parasites of man. The data from these field studies continue to be analyzed and have been the basis of a number of international collaborative research efforts, but represent only a fraction of Dr. Schad's contribution to our understanding of hookworm disease. His research group, for example, has been the only one to maintain *A. duodenale* in a laboratory animal model for more than just a handful of parasite generations. They are now actively involved in the laboratory investigation of the infective process in hookworms. This process remains essentially unknown and if understood could open important new opportunities for prevention and control of hookworm infection.

The Bellagio workshop involved twenty-five speakers from ten countries. In addition to Dr. Schad, Dr. Gary Smith, assistant professor of population biology and epidemiology, participated in the workshop. The proceedings have been reported in *Nature*, *the Lancet*, have stimulated the preparation of a news story about hookworms in *Science*, and will appear later in book form.