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Searching for a Cause of Decreased Litter Size in Swine

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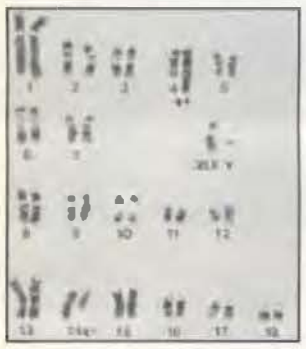
Searching for a cause of decreased litter size in swine

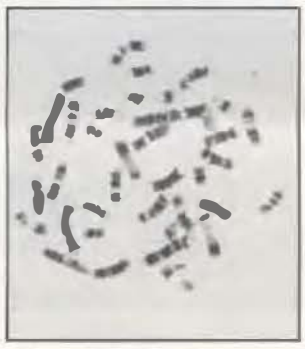
Raising hogs for market is competitive business. The farmer looks for large litters to offset the costs of feed, labor, housing, and veterinary expenses. Small litters can quickly eat into the tight profit margin.

"Reduced litter size is an important cause of lowered reproductive efficiency in swine," said Dr. Richard A. McFeely, professor of reproduction at the University of Pennsylvania School of Veterinary Medicine. "And there is increasing scientific evidence from Europe and Japan that chromosome translocations contribute to reduced litter size in swine." To investigate whether such chromosome translocations play a role in reduced litter size in Pennsylvania swine herds, Dr. McFeely has received a grant for a two-year study from the Pennsylvania Department of Agriculture. "At this time there are no reports of chromosome translocations in swine in the United States," McFeely said. "But studies in other countries suggest that this may be a universal problem in swine."

He explained that swine have 19 pairs of chromosomes. Translocation occurs if a piece breaks from one chromosome and attaches itself to another. This can be caused by an insult to the chromosomes such as radiation, viral infection, or exposure to chemicals. Apparently, it can also happen spontaneously. When translocation occurs, the genetic material of the reproductive cells may become unbalanced and affect the offspring. Scientists have identified nine different chromosomal translocations associated with embryonic death and stillbirth. Animals from small litters may carry the trait and spread it further if they are mated.



Translocation pig karyotype



G-banded metaphase spread of pig chromosomes

(photos by Lynne R. Klunder)

A study in Scandinavia on several boars, phenotypically normal and with good semen quality, turned up some startling results. One boar sired litters with 100 percent embryonic mortality, and he showed evidence of chromosomal translocation. His two full brothers sired litters which were 50 percent smaller than those produced by other sires with the same dams. These two boars also had chromosomal translocations. Further studies of two other boars, father and son, showed that the translocation was transmitted to 41 percent of the son's live-born progeny and that 11 percent of embryos and fetuses studied between 10 and 88 days of gestation had translocations which were lethal.

Normally, a litter of swine numbers eight to ten. Dr. McFeely's study will determine to what extent chromosome translocations may be associated with decreased fertility in swine in Pennsylvania. A questionnaire has been sent to swine breeders asking about litter size. Once herds with small litter size have been identified, a second questionnaire will be sent asking more detailed questions. There will be a kit for obtaining blood samples from the boars in the herd. It is planned that the herd veterinarian draw and submit the sample. The swine producer will be compensated at a fixed rate for each sample submitted.

The blood sample will be cultured in the laboratory, and the chromosomes will be analyzed. This will include specialized banding techniques to identify the individual chromosome pairs. The banded chromosomes will be photographed and then karyotyped. They will be matched, and chromosome abnormalities can become evident. If an abnormality is detected, an attempt will be made to obtain a blood sample from a representative sample of the progeny to determine whether the abnormalities are transmitted.

Initially, the study will focus on boars. "A boar in a herd has many more offspring than a sow," said Dr. McFeely. If chromosome translocations or other abnormalities that might cause reduced litter size are found, an economical method for screening prospective breeding animals will be developed. "Such screening could have a profound effect upon the efficiency of reproduction within the Pennsylvania swine herd," he said. "It would result in economic improvement for the individual breeders."

McFeely stressed that participation in the study is voluntary and that all findings are confidential. "Only the owner of the herd will receive the results of the tests," he said. Dr. McFeely and his associates plan to have this study completed by June, 1988.

—H.W.

Laser Surgery

The surgical laser, developed in 1960, has gradually established its place in human medicine. The Argon laser's most widely publicized application is for repairing retinal detachments in the eye. Uses of the Nd:YAG laser include the transendoscopic removal of laryngeal growths and the palliative treatment of tracheal, bronchial, bladder, and esophageal tumors.

Now, surgeons at the University of Pennsylvania School of Veterinary Medicine are investigating the feasibility of laser surgery in large animals, primarily the horse. "The Section of Surgery at New Bolton Center was fortunate enough to purchase an Nd:YAG laser through the generosity of benefactors interested in helping the horse," said Dr. Eric P. Tulleners, assistant professor of surgery. "The letters stand for the solid substances which produce the laser beam. Our machine is a neodymium-doped, yttrium aluminum garnet, optically pumped laser. The beam is transmitted through a 4-meter-long, flexible fiber, about 2 mm in diameter." A laser beam, a form of electromagnetic radiation, is formed by nearly parallel monochromatic light rays of the same wavelength. The beam is very focused and its intensity varies, depending on the power utilized. The machine at New Bolton provides up to 40 to 60 watts of power for non-contact use, such as vaporization. If a probe is attached for contact use, the power requirement is reduced to 10 to 20 watts. Because the wavelength of the light is injurious to the eye, the surgeon and nurses wear protective goggles when the machine is in use. The unit is portable, self-contained, and it requires a standard 220 volt power outlet. It has its own internal cooling source and is about the size of a washing machine.

A number of horses with upper respiratory tract obstructions have already been treated successfully with the laser at New Bolton Center. The laser can be utilized in open surgery as well as transendoscopically. "We use the flexible fiberoptic endoscope, and the laser fiber is passed through the biopsy channel," said Dr. Tulleners. "The animal does not require general anesthesia; it only needs to be sedated and the area anesthetized with topical (local) anesthetic." Dr. Tulleners feels that laser surgery may be useful in treating such disorders as ethmoid hematomas, entrapment of the epiglottis by the aryepiglottic folds, arytenoid chondritis, pharyngeal polyps, and guttural pouch tympanitis. "Among other soft tissue applications which may lend themselves to laser surgery in the horse are treatment of neoplasms such as sarcoids, posterior digital neurectomies, and cervical adhesions and endometrial cysts in mares."

The intense, focused beam of light produced by the laser can cauterize, incise, or vaporize tissue. All of these procedures can be done through the fiberoptic endoscope, which has a television camera attached. The surgeon needs to be completely familiar with endoscopic views, and he needs dexterity to accurately manipulate the laser fiber in the small spaces inside the animal's body. A laser scalpel can be attached to the fiber to incise or remove tissue in a conventional open fashion.

Laser surgery greatly reduces the time a horse spends in the hospital. The dangers of infection and other complications are reduced, and the animal often can be returned to training much more rapidly than after open surgery. Furthermore, general anesthesia is often not required, and the procedure can be done on a standing horse. In many instances laser surgery can be done on an outpatient basis.

Prior to deciding to purchase the Nd:YAG laser, Dr. Tulleners and Dr. Benson Martin took several courses, including extensive lectures and laboratories, to become certified in the use of the laser. Recently, a lecture series and wet lab for physicians was held at New Bolton, using the unit. In addition to Dr. Tulleners, Dr. Ben Martin, lecturer in surgery, and Dr. Charles Raker, Lawrence Baker Sheppard Professor Emeritus of Surgery, are also pursuing research with this new device. The School is the first veterinary school in the country to acquire this particular type of Nd:YAG contact laser.