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Animal Reproduction in Veterinary Medicine

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Progress in endocrinological and physiological research is enabling scientists to control the reproductive processes of animals. This will surely have a profound influence on the veterinary profession. As agriculture becomes more mechanized and computerized, it is essential that livestock production becomes more efficient so that animal products can continue to compete as sources of human food. One of the aspects of livestock production that can become more efficient is reproduction.

Most herds still have a long way to go before they can approach the reasonable goals of 100 percent calf crops, 200 percent lamb crops and 12 pig litters. Dairy herds must have calving intervals of 13 months or less to be able to get the maximum lifetime milk production from each cow.¹

Historically, as American pet owners have become more affluent they have demanded higher quality and more sophisticated medical treatment for their pets. One of the areas of small animal medicine that can be improved is the control and maintenance of reproductive processes. Many of the basic processes of reproductive physiology and endocrinology are yet to be elucidated in some species.

As late as 1965 one veterinarian had this to say about education in clinical reproduction, 'I have not been impressed by the activities of veterinary schools in this area. Teaching methods remain unchanged; a large body of fundamental information from laboratories of biochemistry, physiology, and endocrinology is not being utilized; and research activity is insignificant. Few departments have even a single laboratory. Again, as in other clinical disciplines, we are failing to attract adequate numbers of qualified teachers and investigators, and we shall not do much better until the intellectual pace is quickened.'²

Another clinician stated 'We have lost influence and research in animal reproduc-
tion. Should we prepare students in animal reproduction, and if we should, why don’t we? Animal reproduction should be taught as a separate entity and not as fragments of medicine and surgery.3

If we accept the premise that reproductive problems are important and will be even more important in the future, then it seems imperative that reproduction be stressed more in veterinary education.

The purpose of this report is to examine how those veterinarians concerned with treating reproductive problems and training future practitioners visualize the present and future status of animal reproduction in veterinary medicine.

**History of Research in Animal Reproduction**

Sexuality and procreation have been driving forces in the lives of human beings from time immemorial. The exact moment when man first correlated sexuality and reproduction with the anatomy and physiology of the animal body is lost in antiquity, but man and domesticated animals have been castrated from very early times. Aristotle (384–322 B.C.) described the effects of castration in the bird and compared the involuntary changes with those that occur in eunuchs.4 The literature indicates that John Hunter, a British surgeon, had successfully transplanted avian testes in 1771 or earlier.5 In 1849, A.A. Berthold, after transplanting testes into the body cavity of capons, concluded that the testes release something into the blood that maintains male behavior.4 This observation along with those of Claude Bernard and Thomas Addison on metabolic diseases were the seeds of the new science of “internal secretion” or endocrinology.

Although discoveries in anatomy, physiology, pathology and microbiology have helped immensely to improve our knowledge of normal and abnormal reproduction, it is the science of endocrinology that has been the impetus for solving the mysteries of reproduction. The early work in this field was done by physicians, zoologists and chemists back in the days before specialization, when a scientist worked on whatever fascinated him the most. Later on, endocrinology was taught in agricultural courses, and animal scientists were eager to apply basic findings to domestic animal production. Agricultural scientists in Great Britain began to use domestic animals in endocrinological experiments around the turn of the century. Foremost among these early leaders were W. Heape and F.H.A. Marshall at Cambridge University.

The really enlightening discoveries in reproduction were made in the last 50 years by zoologists, medical scientists and animal scientists. This half century of growth in the knowledge of reproduction began with the studies of Stockard and Papanicolaou on the estrous cycle of the guinea pig6 and similar studies on the mouse and rat by Edgar Allen.7 Allen and Dolsy discovered the hormone estrogen during the 1920’s, and Ascheim and Zondek discovered human chorionic gonadotropin in 1927.8 Corner and Allen discovered progesterone in 1929.9 The pituitary gland was found to be involved in the physiology of reproduction in the 1920’s, also, but the different gonadotropins were not extracted in pure form until three decades later. During this time, the reproductive cycles in domestic animals were being investigated in the laboratories of John Hammond at Cambridge, F. F. MacKenzie at the University of Missouri and S. A. Asdell at Cornell University. Sir John Hammond had a tremendous impact on basic and applied research in the physiology of reproduction of farm animals. He was largely responsible for the large scale artificial insemination of dairy cattle that began in England during World War II.10

After World War II many reproductive physiologists were trained in animal science departments of agricultural colleges in Europe and the United States. This trend continued until there are several reproductive physiologists in most animal science departments at this time. As a result, there has been a tremendous explosion of knowledge about normal reproduction in food producing animals within the last two decades.

Veterinary medicine is as old as recorded history, but the distinction between
veterinary art and veterinary science is a subtle one. Both the art and the science are essential for successful veterinary medicine. The real impetus to the development of veterinary science is usually considered to be the founding of the veterinary schools of Europe in the late 18th century. The veterinarian remained, for the most part, a practitioner of the art of veterinary medicine until after World War II.¹¹

Research in the infectious diseases of domestic animals was the first undertaking by the veterinary scientists and they have been very productive in this endeavor. Thus, the infectious diseases affecting reproduction have received considerable attention by veterinarians. Bang identified the causative agent of contagious abortion in 1896.¹² *Vibrio fetus* was recognized by veterinary scientists as a cause of abortion in 1911, and *Trichomonas fetus* infection was recognized as a cause of infertility in cattle in 1932.¹³ However, the study of the causes and processes of infertility, other than infection, is of fairly recent origin.¹⁴

**Methods of Questioning**

How is animal reproduction being taught in veterinary schools in 1969, and to what extent are veterinarians engaged in reproduction research? How do our educators and practitioners think reproduction should be taught, and to what extent do they think veterinarians should engage in physiology of reproduction research? These questions and others were asked of veterinary academicians and practitioners engaged in reproduction practices.

Administrators of twenty-one veterinary schools in the United States and Canada were asked the following questions concerning teaching and research in reproduction at their institution.

1. Where do your students acquire knowledge of animal reproduction?
   A. Basic physiology and endocrinology of reproduction?
   B. Pathology of reproductive processes?
   C. Clinical reproduction and obstetrics?
   D. Are any changes contemplated in courses and clinics dealing with reproduction?
   E. Does your institution have provisions for continuing education in this area of study and practice?

2. How many scientists in your veterinary college spend the majority of their research energies on animal reproduction? Has the number increased, decreased or remained the same in recent years?

3. How many clinicians in your institution spend the majority of their time teaching and practicing reproduction and obstetrics? Has the number increased, decreased or remained the same in recent years?

4. Is the discipline of Animal Reproduction and Obstetrics represented by a separate department or sub-department, or is it a part of Medicine and Surgery or Clinics in your institution?

5. What percentage of your graduates and/or practitioners in your area are engaged in specialized fertility practices? In specialized herd health and preventive medicine practices?

6. How can veterinary education be improved to insure better veterinary services in the area of Animal Reproduction and Obstetrics?
   A. Specialized practitioners?
   B. More training for all practitioners?
   Practitioners who are specializing in fertility and/or herd health practices were asked the following questions.

1. Is there a need and a place for more practitioners specializing in reproduction (fertility and obstetrics)?
2. If so, in what areas?
3. What do you believe are the qualifications needed for specialization in reproduction?
4. If advanced education and training is needed can the specialists expect higher fees to offset the cost?
5. How do you envision that animal fertility and obstetrics problems will be handled in the future?
6. How can veterinary education be improved to insure better services in the area of fertility and obstetrics?
Results of Questioning

Veterinary schools classically teach basic anatomy and physiology of reproduction in the anatomy and physiology courses during the first year of the professional curriculum. Four schools require a course in animal reproduction from an animal science department in their pre-vet curriculum. Pathology of the reproductive organs is taught in second year special pathology courses and basic anatomy, physiology and pathology are reviewed at the beginning of a course in obstetrics. Fifty eight percent of the colleges contemplate changes in their curricula regarding the teaching of reproduction while 42 percent do not. Seventy five percent have continuing education courses in reproduction while 25 percent have none.

The number of scientists conducting research primarily concerned with animal reproduction ranges from zero in two veterinary schools to a high of ten in one school. The average number is three and one-half researchers. Two-thirds of the institutions have increased the number of researchers in reproduction in recent years and the number has remained the same in one-third of the schools.

The number of clinicians working in the obstetrics and reproduction area is more static. Only 25 percent of the schools have increased the number of clinicians while 75 percent have the same number. The average number of clinicians is two.

Two veterinary schools have separate departments of Obstetrics and Reproductive Disorders and four have sub-departments within their departments of Medicine and Surgery. The rest of the schools incorporate clinical reproduction within their medical and surgery clinics.

Very few practitioners are presently engaged in specialized fertility or herd health and preventative medicine practices. Figures are not available in most parts of the continent, but estimates are consistently below one percent. The practitioners specializing in animal reproduction are located in areas of concentrated dairy cattle, beef cattle or race horse populations. Several practitioners in cattle and swine raising areas have practices made up largely of herd health and preventative medicine programs.

Seventy-five percent of the specialized practitioners polled believe that there is a need and a place for more practitioners specializing in reproduction while 25 percent think this is questionable. Problems of the specialists are in travel, in crossing state lines and in veterinary politics. Several specialists believe that the lack of a specialty board for determining who is really qualified to specialize in reproductive problems is a deterrent to expansion. These practitioners echo the sentiments of the educators that specialization is needed, but only in certain geographic areas. Some feel that in the future a few specialists will be needed in small animal reproduction in large cities located some distance from schools of veterinary medicine.

The lists of qualifications needed for specialization are varied, as should be expected, but those most often mentioned are good training, experience and an open and inquiring mind. One-half of the respondents believe that specialists should not expect higher fees for their services. Their views are that specialists should perform better because of advanced training and experience. Therefore, they should profit from increased volume and better clientele. About one-fourth of the specialists feel that higher fees can be expected for superior service and the rest are not certain.

The practitioners are hesitant to predict how reproductive problems will be handled in the future, but they all have ideas as to how they think they should be handled. In general, they believe that the veterinarian should be used more as a consultant. He should direct preventive medicine programs with the herdsman doing more of the routine procedures. There should be close cooperation among the veterinarian, herdsman and A.I. technician. The veterinarian should be willing, and have the opportunity, to consult with endocrinologists at state universities on difficult fertility problems. They believe that the herdsman of the future will be better educated and more responsive to herd health programs. They sound warnings that unless large

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animal practitioners improve pregnancy diagnosis and semen evaluation, they are liable to lose these aspects of practice to artificial insemination technicians. Most think that the clinical reproductive specialists of the future will be associated with a group practice. This will help alleviate the problem of professional politics and jealousies over areas and boundaries. A speciality board affiliated with the American Veterinary Medical Association is envisioned by most respondents. The clinics of veterinary colleges will continue to be sources of specialized treatment for valuable animals.

In answering how veterinary education can be improved in the area of animal reproduction, 70 percent of the educators state that veterinary schools should train specialized practitioners and there should also be more training for all practitioners. Thirty percent feel that all practitioners should have more training in reproduction, but specialists should not be produced.

Opinions on how veterinary education can be improved are varied, but answers received from academicians and practitioners are not substantially different. The variation among academicians and among practitioners is great, however. The most universal change mentioned is the need for more and better continuing education courses. Both groups feel that most of today's practitioners have not had the opportunity to learn reproduction thoroughly enough to function properly in a herd health situation, and that continuing education will be the quickest way to upgrade the profession as a whole. Most agree that students should receive more education in reproduction, but there is controversy as to whether this should be taught in the basic science courses, in clinics, or as a separate discipline. There is also sentiment for teaching it before or after formal professional training. Many specialized practitioners believe that the subject could be taught as it is presently if more dynamic, better trained instructors taught better organized, illustrated and demonstrated courses. Many feel that a complete reproduction curriculum should be taught rather than just obstetrics and reproductive diseases. Several respondents feel that a vigorous on-going research program in clinical reproduction is needed for excellence to be present in clinics. It is also suggested that some institutions should concentrate on making reproduction a field of excellence in their veterinary school. Recent graduates could then go there for advanced training. Many believe that arrangements can be made with animal science departments for service courses in physiology of reproduction for professional students. Practitioners believe that more economics and business should be taught in veterinary schools, especially to those who will be working with herd health programs.

Discussion

The results of recent queries to veterinary schools and practitioners engaged in specialized reproduction practices confirm the findings of symposia sponsored by the Council on Education of the American Veterinary Medical Association published in 1965. It is agreed that the veterinary profession should become more involved in the endocrinology and physiology of animal reproduction. The controversy lies in how the profession should go about doing this. It is a matter that will ultimately be decided by administrators, but the impetus for change and the direction of change should originate with the profession as a whole. Those of us who are interested and affected by trends in the livestock industry and companion animal medicine need to become informed of the situation, and make our feelings known to groups studying veterinary education. Veterinarians can rely on collateral fields such as Animal Science and Human Medicine only to a certain extent. We can benefit from the results of their research, but there will undoubtedly be some holes left in our view of reproductive problems if we rely only on the results of research in the normal animal and the abnormal human. The veterinary scientist should be uniquely trained to study reproduction in abnormal animals, but to do this he must adequately understand the normal animal.
To keep abreast of information in animal reproduction, practitioners need to attend continuing education courses and read journals in which basic animal reproduction information appears. It is true that veterinary journals often abstract from these sources, but they are usually several months behind and the information abstracted may leave out data that could be helpful to the practitioner. Some of these journals are: Journal of Reproduction and Fertility, Biology of Reproduction, Journal of Animal Science, Journal of Dairy Science, Endocrinology, Fertility and Sterility, Journal of Endocrinology, International Journal of Fertility, and Proceedings of the Society for Experimental Biology and Medicine.

In the future, more vigorous culling of reproductively inefficient animals is going to take place. The veterinary practitioner is going to have to be able to determine which cases of infertility can or should be treated and which ones should be culled. This is a tremendous responsibility to the client since desirable production traits often are inherited simultaneously with a tendency for inefficient reproduction.

Many veterinary schools are beginning to emphasize research in reproduction as evidenced by the increase in number of personnel doing research in this field. Many of these men have been trained in collateral fields and are working to establish research programs and graduate training programs in veterinary schools. Some veterinarians advocate that to have a good clinical program you need to concurrently have a good research program. This seems to be especially true of clinical reproduction. Several veterinary schools are developing fields of excellence in animal reproduction where scientists and clinicians are working together to provide a learned atmosphere for teaching basic and clinical reproduction.

Conclusions

None of the respondents to the questionnaires discussed in this paper want to predict the future, but it appears that considerably more basic and applied research in animal reproduction is going to be conducted in veterinary colleges. All practitioners will be trained more fully in animal reproduction in the future. Many of the less complicated obstetrical procedures will be performed by lay personnel and many large animal practitioners will be practicing clinical reproduction as part of herd health programs. There will be a few reproductive specialists in group practice with other veterinarians that are specialists in other aspects of veterinary medicine. There will be many opportunities for the veterinary student interested in animal reproduction.

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BIBLIOGRAPHY