

A Rational Approach to the Development of Diagnostic Techniques and Therapeutic Regimes for Subfertile Bulls

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Development of artificial insemination, the increasing value of individual animals, and the recognition of infertility problems in outstanding sires has resulted in the acceptance of prophylactic examination of bulls prior to their addition to herds or artificial insemination centers. Breeding soundness evaluation usually consists of a general physical examination with emphasis on sex organs, and a detailed examination of semen.

Although little is known about the relationship between these observations and fertility of the sires in question, such evaluation techniques have proven useful in identifying grossly abnormal animals. Carroll, *et al.*¹ were able to show that twenty-one percent of 10,940 bulls examined were rated as questionable to definitely unsatisfactory for breeding service. Roman, *et al.*² investigated the life span and reasons for disposal of beef sires in AI centers. They found the useful life span of bulls to be only 3.15 years. Sixty-three percent of beef sires culled during the course of this experiment were removed from service due to problems related to reproductive capacity.

Infertile bulls are sold for slaughter in most instances because it is not economical to treat them. Veterinarians are being asked with increasing frequency to diagnose and treat the causes of lowered fertility in valuable animals. If rational treatments are to be devised to deal with subfertile bulls, veterinarians and livestock scientists need to evaluate the effects of diverse factor (e.g. aging, temperature, nutrition, management practices, etc.) upon the germinal epithelium and endocrine secretions.

The author has examined hundreds of bulls during his tenure as a bovine practitioner. It has been our experience that elimination of bulls suffering from infectious disease or physical disability from a subfertile group leaves a sizable number of animals which for no apparent reason lack libido or produce semen distinguished by reduced motility, vigor, and number of spermatozoa. Such symptoms indicate a probable physiological, as opposed to

pathological, cause. Numerous studies with males of other species suggest that endocrine dysfunction is the most important cause of impaired spermatogenesis. It is well known that pituitary and testicular hormones play the major role in regulating sex drive and proper functioning of the germinal epithelium. However, successful and economical treatment of subfertile sires by veterinarians requires a battery of diagnostic aids not presently available. These tests ideally should relate quantitative and qualitative endocrine and spermatogenic changes with alterations in semen production and sex drive, thus allowing the veterinarian to pinpoint the etiology of the dysfunction. A prognosis could then be made and a rational therapeutic regime initiated.

Potential Diagnostic Aids

Although knowledge of male endocrinology and reproductive processes related to infertility is slight, there is hope that quantitations of specific hormones in circulating blood might prove to be important diagnostic tools. Endocrinologists and reproductive physiologists are presently engaged in a variety of studies which could yield information of great clinical significance. Research workers have developed techniques which can be used in determining circulating levels of hormones in abnormal, as well as normal, animals. Peripheral blood levels of the androgenic steroids can now be determined routinely in several laboratories, using either gas-liquid chromatography with electron capture detection, or double isotope derivative methods. In addition, perfection of a more rapid and economical protein-binding method appears to be imminent. Bovine pituitary interstitial cell stimulating hormone, and other anterior pituitary hormones can now be measured in circulating blood by means of radioimmunoassay techniques. Fluorometric and protein-binding assays make it possible to determine peripheral levels of adrenal corticoid hormones. Most of these techniques could be used to evaluate clinical reproductive

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problems at the present time if economic considerations could be ignored.

Quantitative endocrinology has proven useful in laboratory animal research and human clinics. There is ample reason to believe it could be used with equal efficacy in the bull. Presently, the normal circulating levels of anterior pituitary, adrenal and testicular hormones are unknown. Research in progress should remedy the situation. The author, for example, has adapted steroid techniques originally developed for use in laboratory animals to use in the bull. Peripheral blood samples collected over a period of months from eight Hereford bulls, fourteen to twenty-four months old, have been analyzed. Although the study is incomplete, data have been assembled which indicates the following are physiological values for these bulls:

HORMONE	<i>µg/ml plasma</i>
Testosterone	3.50
Androstenedione	0.20
Cortisol	13.00
Corticosterone	2.00

Armed with this type of information, provided with the proper facilities, equipment, personnel, etc. the veterinary clinical researcher is now in a position to correlate testicular and adrenal function in normal bulls with those bulls suffering some reproductive malady.

Implementation of Program to Develop Diagnostic and Therapeutic Regimes for Subfertile Bulls

Practitioners and researchers alike need to address themselves to one important question: "How can the information now becoming available from basic research most rapidly, effectively, and economically be put to use for the common good of the livestock industry, the veterinary profession, and the scientific community?" It seems obvious that each of these groups can benefit from rapid development, dissemination, and application of new knowledge in the field of reproduction in general, and in male reproductive problems in particular. Male reproduction has been ignored too long. It is now time to recognize the truth in the old adage, "A good bull is half the herd, but a bad bull is the entire herd."

One mechanism which might afford a solution to the question posed above would be the development of area or regional reproductive diagnostic laboratories in conjunction with clinical research facilities. The benefits of such centers would be (1) providing veterinary practitioners with diagnostic and consultative services, (2) compiling large numbers of case records, (3) determining normal values for use as diagnostic criteria, (4) identifying precise fertility problems in bulls, (5) relating changes in

specific physiological parameters to types of infertility syndromes, thus developing diagnostic aids, and (6) developing and evaluating therapeutic regimes.

It is visualized that these centers would be staffed by specialists from a number of related fields (veterinarians, experimental physiologists, animal scientists, etc.). It is doubtful that more than a few of our veterinary schools would be willing or able to bring together the personnel and scientific equipment needed to insure the success of such an enterprise. Financial support for such facilities could be secured from a number of sources, including state and federal extension grants, research grants, teaching funds, etc. Such broad-based financing would allow diagnostic and clinical services to be provided for veterinarians and livestock owners economically.

Initially, most animals would need to be brought to the laboratory-clinic so that large numbers of cases could be studied in detail. Then, as specific physiological changes could be related to specific reproductive syndromes and effective treatment developed, only a few of the most difficult cases would need to be presented. Diagnostic kits could be provided for the use of local practitioners for the collection of blood, semen, or tissue samples. Such samples, along with a detailed case history, would then be returned to the laboratory for evaluation. After the needed tests were conducted, the results, along with expert opinions and recommendations would be made available to the veterinarian, who, in turn, would perform the necessary treatments.

Summary:

An attempt has been made to discuss some of the past, present, and future problems related to the diagnosing and treating of male infertility. The discussion has been confined purposely to the male bovine, although the reader must realize that in most instances the remarks might apply equally well to either sex or a variety of species. Evaluation of endocrine function has received special emphasis because proper hormonal relationships are absolutely essential for maximum fertility.

The establishment of regional centers of excellence in reproductive study and treatment has been advocated as the answer to our lack of practical knowledge of this field. The veterinary practitioner, the livestock industry, and the scientific community could all benefit from such a solution.

REFERENCES

1. Carroll, E. J., L. Ball and J. A. Scott. 1963. Breeding Soundness in Bulls—A Summary of 10,940 Examinations. *J. Am. Vet. Med. Assn.* 142:1105.
2. Roman, J., C. J. Wilcox, R. B. Becker and N. Koger. 1967. Life Span and Reasons for Disposal of AI Beef Sires. *J. Animal Sci.* 26:136.