

Field Application of a Bull Breeding Soundness Examination

M. Nichols, BS, DVM*

J. Thompson, DVM**

Introduction

Through the efforts of many veterinarians, breeding soundness examination of bulls has emerged as an important tool to improve the reproductive efficiency of cattle.¹ Breeding soundness examinations of bulls will enjoy even greater acceptance in the future as the cattle industry becomes more efficient.¹ Management of bull selection, and evaluation of the bull's performance are important aspects of beef improvement.² Breeding soundness examinations can be used as a diagnostic aid in herd fertility problems. For example, if bulls in a problem breeding herd are satisfactory potential breeders one needs to look for an infectious disease, cow infertility, nutritional deficiencies or other conditions as the cause of infertility. It should be noted that the breeding soundness exam does not reflect the bull's past soundness, nor does it define the bull's ability in the future, but it does allow one to make a prognosis of future fertility.¹ The overall thrust of a breeding soundness exam is to eliminate many infertile bulls and improve the genetic base for fertility within breeds.¹ Both testicular size and semen morphology are improved by selection based on culling of inferior bulls detected in these examinations. These are economic factors in semen production.¹

To further illustrate the importance of a thorough breeding soundness exam — a recent study by Wiltbank and associates involved a trial using 3,600 cows. Half of the cows involved were placed in pastures with bulls that had excellent semen morphology and large testes, and the other half with bulls with semen quality representative of the unselect population. The cows placed with satisfactory bulls weaned 7.4% more calves which were heav-

ier. In the breeding soundness exam group of bulls over \$17.00 was returned by each cow over that returned by the cows bred to bulls representing an unselected population. A cost of \$30.00 was assigned to the BSE for these calculations. This study illustrates that a breeding soundness examination performed prior to the breeding season can increase profits.¹ Another illustration of economic benefit from a breeding soundness program is the positive effects on heifers which conceive early in their first mating season. By using bulls with acceptable semen quality, libido and mating ability, heifers will conceive early and therefore calve earlier. This is important because an early calving heifer: 1) weans a heavier first calf; 2) has a greater chance of conception as a first-calf cow than a late calving heifer; and 3) has a greater chance of calving early it's second and subsequent calvings and thus weaning heavier calves over its life time than a late calving heifer.³ Furthermore, to maximize the chances of heifers conceiving early in their first mating season it should again be emphasized that they be mated to bulls with high serving capacity. The first estrus conception rate is higher in heifers mated to bulls with medium serving capacity. Thus they will conceive earlier in the breeding period.³

It should be noted that in most large cow and calf operations, bulls are the only herd additions. Care must be taken to prevent the introduction of disease into the cow herd at this time. Adequate selection, testing, worming, vaccinations and isolation of new bulls is mandatory.²

Why BSE?

Animals are usually presented for a breeding soundness exam for four basic reasons. The first reason is a prebreeding exam. Bulls are examined, usually a month before breeding, so that one knows for sure that they are normal before they are placed in with females.³ The second reason for a BSE is during the breeding season when an abnormal number of females are returning to estrus. A third

*Dr. Nichols is a 1986 graduate of the College of Veterinary Medicine at Iowa State University.

**Dr. Thompson is an associate professor in the Department of Veterinary Clinical Sciences at Iowa State University.

reason is a pathology consideration in which the bull is suffering from frostbite, testicular swelling, an inability to service, or a systemic disease. The final reason for a BSE is a presale exam, thus making sure the animal is a sound potential breeder before the bull is sold in the ring.⁴

What Should a BSE Include?

The breeding soundness evaluation must include a complete physical examination, rectal examination, scrotal circumference measurement and semen collection and evaluation.² Special emphasis should be placed on evaluation of libido, mating ability, musculoskeletal system, penis and prepuce, and also the condition of the testicles.^{1,3} By applying standardized examination procedures important aspects will not be overlooked and evaluations by different veterinarians are more likely to yield similar results.¹ Both objective and subjective data are gathered during a soundness exam and used to classify a bull as a satisfactory, questionable or unsatisfactory potential breeder.¹

Practical Application of the BSE

Ideally the field examination should be performed 30 to 60 days in advance of the breeding season to allow the cattleman time to locate adequate replacements and appraise his existing bull power.¹

1. As stated before, the sequence of events should be standardized so that the exam is thorough and repeatable. The first component of the BSE is the physical exam. Under this heading topics such as libido, mating ability, social dominance, weight and condition, rear leg structure, vision, teeth, penis, prepuce, testis, scrotum and epididymis are evaluated.

1. Libido is an important component of breeding soundness, however it is difficult to make an assessment of libido as a part of a breeding soundness examination. Bulls must be observed under natural breeding conditions.^{1,2} When available, a libido evaluation is a valuable way to more accurately assign the bull/cow ratio.² In many areas, this ratio is 25 cows per mature bull, and 20 cows or less for yearlings and 2 year old bulls. This ratio will also vary in relation to terrain, watering facilities, and desired length of the calving season.² The use of yearling bulls has become common practice. This usage of yearling bulls requires careful management because these bulls often are carrying extra condition, and it is common that younger bulls do not possess the semen reserves that the mature bulls do. Problems could arise on a warm humid day when

2 to 3 cows are in heat. The bull can quickly become exhausted, both physically and reproductively before all the cows are properly covered that day. Therefore, if possible, these bulls should be used on a rotational basis with a rest period every two to three weeks. It has been demonstrated that there is a significant increase in the ability to impregnate heifers by bulls that are graded high and medium for libido compared to bulls with low libido.¹

2. Mating ability is the ability of the sire to locate, mount and serve cows that are cycling. Mating ability is impaired by problems of the musculoskeletal system, especially unsoundness of rear legs and lower back. Problems such as deviations or loss of innervation to the penis, which may be a sequelae to hematomas, may also reduce mating ability. Careful questioning of the owner may give insights as to causes of failure of both mating ability and libido of bulls.¹ All bulls should be turned in with estrous females and be observed by a veterinarian and/or owner to detect deficiencies in libido or mating ability.¹ On the average a bull given unlimited opportunity has the maximum frequency of 10 services per day with an average of 1.7 services per female.⁴

3. Social dominance: Bull subfertility has serious consequences when the infertile or impaired bull is also the dominant bull in multiple sire pastures.¹ The dominant bull being infertile would keep more timid, fertile bulls from settling the cows, while being unable to impregnate them himself.

4. Weight and condition: Bulls should not be fat, but should carry some extra weight going into the breeding pasture, because they can be expected to lose weight during the breeding season.¹ Young bulls coming off performance tests may, because of the heavy feeding, have enough fat in their scrotum to increase scrotal circumference by 2 to 3 centimeters.^{1,5} Therefore breed, age, and weight as well as condition must be considered when interpreting scrotal circumference measurement.⁵

5. Rear leg structure: Range animals are expected to travel some distances and good feet and legs are essential. The postlegged condition causes pressure on the joints resulting in pain and an inability to mount. The sickle-hocked condition causes a tiring of the animal with increased travel and results in a lack of desire of the animal to mount. A narrowed chest floor, which is caused by the front legs being set close together, prevents some sires from mounting larger cows.⁵ A bull whose legs hurt may not find cows in estrus nor mount them successfully. Also, cows may be bred less often by bulls with rear leg pain, which might result in a reduced

conception rate. As a bull with faulty rear leg conformation ages, the defect becomes more apparent and interferes more and more with the animal's breeding ability.¹ The feet should be examined for weak pasterns, damaged dew claws and corns between the hooves (interdigital fibromas). Breeders should be warned that structural faults of the rear legs are often heritable.¹

6. Vision: Common eye problems include pinkeye, trauma scars, and squamous cell carcinoma. Scars resulting from infectious keratitis seldom obscure a bull's vision enough to impair breeding ability. Early cancer eye should be a reason for slaughter or surgery because these lesions can develop rapidly, reducing salvage value, and interfering with breeding competence.¹

7. Oral: Examination of the oral cavity is in order to detect oral deficiencies that would prevent proper prehension and mastication of feed. This would inevitably lead to a weight loss condition thus affecting the bull's performance in settling cows.

8. Penis and prepuce: Penile deviations can be evaluated accurately only when the bull mounts a teaser animal or breeds a female.¹ Upon erection and extension, the penis may be examined for deviations in any direction other than normal. The coiling of the terminal penis is normal, and it usually straightens after several stimulations. Lateral and vertical deviations are rare. Growths on the penis and any opening of the urethra other than normal should be observed.⁵ Virgin bulls should be examined for normal development of the penis and freedom from prepuberal adhesions and developmental anomalies such as persistent penile frenulum.¹ Certain breeds, such as Shorthorn, Angus, and Santa Gertrudis have a higher incidence of persistent penile frenulums than other breeds.¹ One should also be watchful for the development of a hair ring around the penis. This condition occurs most commonly when yearling bulls are housed together and mount one another; hair accumulates on the extended penis.

Caution is called for when using an electroejaculator to evaluate the penis for deviations. The stimulation produced by an electroejaculator often produces temporary deviations or other abnormal configurations in the normal bull penis. Therefore, as stated earlier it is best to evaluate for penile deviation by observing natural matings.¹

The prepuce is best examined when the bull is being stimulated with an electroejaculator. The prepuce should be examined for freedom from defects. Palpation of the prepuce allows one to determine whether or not adhesions are present. Bulls of *Bos indicus*, or synthetic breeds utilizing *Bos indicus*

blood such as the Santa Gertrudis breed, often have a loose pendulous prepuce which predisposes it to traumatic lesions.¹

Eversion of the prepuce is found to some degree in all bulls carrying the polled gene and also in *Bos indicus* breeds. Horned bulls seem unaffected by this condition. Bulls with a high degree of eversion are more subject to preputial laceration, frostbite, etc. The term paraphimosis is used to describe a bull's inability to retract the penis back into the prepuce. The term phimosis indicates that the bull is unable to extend the penis from the prepuce.¹ A fibrotic preputial orifice may become strictured enough to increase the risk of phimosis or paraphimosis. Palpation of the orifice assists in this diagnosis.^{1,5}

9. Testes, scrotum and epididymis: Even before palpation of the testes one should observe the testes for symmetry. Normal testes are almost always symmetrical. Any deviation from balance and symmetry should be evaluated carefully.¹ When evaluating the testes, size, shape, form and consistency should be assessed. Bulls with very long testes may have significant cleavage of the scrotum between the tails of the epididymides. This normal anatomical modification of the scrotum does not interfere with testicular function; neither does rotation of both testes up to about 40 degrees. Testes held close to the body wall and sometimes tilted posteriorly are usually small. This condition is most often seen in high gaining bulls or in bulls with muscular hypertrophy or double muscling.¹ Clinically, one may be unable to distinguish between hypoplasia and degeneration of the testes via palpation. In many cases both hypoplasia and degeneration may be present. The tone of each testis should be determined by palpation and the distinction should be made between firm, live-feeling, normal testes and those having a meaty or muscular texture. Fibrous testes which are found, particularly in older bulls, should be identified since spermatogenic tissue has been replaced and production reduced in such instances. Soft spongy testes indicate poor production and that the tubules are not full and turgid. The temperature of the testes should be noted also as infection will cause fever.⁵ The cryptorchid condition occurs in bulls, but the veterinarian should be aware that more often one testis is only partially descended and the other is fully descended into the scrotum causing a "high-flanker" condition. It should be kept in mind that bulls with abnormalities of the testes should not be used for breeding because most of these defects are heritable.¹

The scrotum should be pendulous yet well suspended. The outer skin of the scrotum should be

examined for indications of earlier damage such as scratches, punctures, lacerations, frostbite and infections.⁵ Scrotal hernias can be palpated as a soft enlargement of the scrotal contents, especially evident at its base. The diagnosis is verified by rectal palpation of abdominal viscera passing through the internal inguinal ring.¹

The epididymis should be palpated in its entirety. The tail of the epididymis is a good indication of sperm production since it stores sperm. The bulging tail of the epididymis should be visible even without palpation in the normal state. Watch and feel for excessive swelling and heat, which would indicate infection and/or inflammation. Fullness and firmness, not hardness, should indicate abundant sperm. Soft or flaccid conditions may indicate poor production or overuse.⁵ The head of the epididymis should be palpated carefully for nodular enlargement indicating sperm granulomas which may eventually cause occlusion of the epididymal duct. Mild clinically undiagnosed inflammations of the epididymis are fairly common and usually occur in association with vesiculitis.¹ Hypoplasia or aplasia of the epididymis has been linked to segmental aplasia of the mesonephric duct system during embryonal development.¹

II. The second component of the breeding soundness exam involves a thorough rectal examination. Structures that should be examined include: the vesicular glands, ampullae, urethral area and the internal inguinal rings.^{1,5}

The vesicular glands are a lobulated pair of organs that lie in the pelvis, about wrist deep. Vesicular gland adenitis (vesiculitis) is one of the most common pathological conditions encountered in the bull. It is most often found in the young and very old bulls. Vesiculitis is usually diagnosed by palpation, noting the changes in size, shape, and consistency of the gland. Vesiculitis is characterized by enlargement, induration and loss of lobulation and is often associated with decreased semen quality.¹ Findings on rectal examination of the vesicular glands should be correlated with the presence of increased numbers of white blood cells in the semen to verify a diagnosis of vesiculitis. Fairly common sequelae to vesiculitis are orchitis, epididymitis, and ampullitis. Therefore, a bull that is diagnosed as having vesiculitis should be classified as questionable and the course of the disease monitored by repeated examination.¹ Therapy has proven to be a challenge due to its location. It is difficult to achieve adequate antibiotic levels to combat the infection.

The ampullae has a normal circumference slightly greater than that of a standard pencil, and is locat-

ed between the vesicular glands. Ampullitis usually occurs in conjunction with inflammation of other reproductive organs.¹

Palpation of the urethral area may show a swollen prostate. Inflammations generated by vesiculitis often affect the prostate.¹ If the inflammation is severe enough the prostate may put pressure on the urethra and thus affect urine outflow.

When palpating the internal inguinal rings, one should note the spermatic cord as it journeys through the rings. As stated before, one should be aware of possibility of gut loops that have passed through the rings to the scrotum. As a rule of thumb for ring sizes, if the slits of the internal rings are wider than 4 fingers, the propensity for herniation is said to be increased.¹

III. The third part of the breeding soundness exam is the scrotal circumference measurement. A measurement of the scrotal circumference is probably the best single method of predicting the ability of a young bull to produce spermatozoa. When properly performed, measurement of scrotal circumference is highly repeatable, both by the same veterinarian and among other veterinarians.^{1,2,6} Therefore, it is probably the best measurement available for field evaluation of semen producing capability of old bulls, though correlations are not as good as with young bulls.

To measure scrotal circumference the testes are pulled firmly into the lower part of the scrotum by encircling its base with the hand and pulling down on the testes. The thumb and fingers should be located on the side of the scrotum rather than the front to prevent separation of the testes, which results in inaccurate measurement.^{1,5} Special care should be taken when the weather is cold to pull the testes down into the scrotum thus avoiding faulty measurements. Following placement of the testes a loop of flexible measuring tape is slipped over the base of the scrotum and the greatest diameter of the scrotum, with both testes in place, is measured.⁵

Large numbers of bulls have been measured in Saskatchewan, and data collected. This data indicates that beef bulls will rank satisfactory 90% of the time if the scrotal measurements are 41 centimeters or greater. If measurements are over 38 centimeters, greater than 80% will be satisfactory. If they measure 36 centimeters or greater, 70% of the bulls will be satisfactory.⁵ Most yearling beef bulls should have a scrotal circumference of at least 30 centimeters.¹ Young bulls with relatively small testes have relatively small testes when they are mature. Thus an accurate prognosis of potential semen production capacity can be made for most bulls

when they are young. Also worth noting is that young bulls with above average scrotal circumference should produce heifer offspring that mature earlier because age at puberty in heifers is favorably correlated with scrotal circumference in their half-sib brothers.¹ In summary, bulls with a large scrotal circumference have more semen, a higher prevalence of normal spermatozoa and increased sperm motility than those with small testes.¹ As a side note, cattlemen should be warned that zeranol implants used in prepuberal bulls will decrease scrotal circumference and retard sexual development.¹ When testing bulls of Zebu breeding, testes may be naturally smaller. They mature nearly a year later than bulls of European breeding.¹

IV. The fourth part of the BSE deals with the actual collection of the semen sample. There are two common methods used to collect semen in the bull: electroejaculation and artificial vagina.

Semen obtained by electroejaculation differs in some significant ways from that collected from the same bulls by artificial vagina. Concentration usually will be lower and volume higher. However, total sperm numbers are similar and motility is usually not affected. Semen frozen after either method of collection has similar fertility.^{1,5}

The artificial vagina is the method of collection that is closest to the natural condition and is assumed to yield the most normal ejaculate of all methods used. The artificial vagina is basically the same for all males. It consists of an outer rigid or semirigid support with an inner jacket containing controlled temperature water and pressure and a collecting funnel and container.⁵ The temperature inside the vagina should be 45-50 degrees Centigrade at the time of semen collection. Many bulls will mount, but fail to serve the artificial vagina if its temperature is too cool. If too hot, semen may be damaged or the penis may be burned.¹ Collection of semen via the artificial vagina is the main method of collection in most bull studs. For most bulls, the mount cow need not be in estrus but merely restrained in a head catch.¹

There are a number of reputable electroejaculators on the market. One of the first to find wide use was the Marden Electroejaculator. This unit is designed on a vacuum-tube chassis and requires a source of electricity for power. Another commonly used electroejaculator is the Lane Pulsator II. A unit manufactured by Standard Precision Electronics is a small compact model that takes up little space and carries a battery sufficient for 50 to 100 collections per charge.¹ Rectal probes are required for this method of collection. A normal bull probe size is approximately 7.5 x 40 centimeters.^{1,5} Probe de-

sign has changed from electrodes encircling the probe to newer models which contain three electrodes on the ventral surface. This new design is an attempt to reduce stray electrical stimulation to the rear legs. The small standard precision unit has an optional hand-held finger electrode.⁵ It was designed originally for collecting Charolais bulls but now has found favor in giving favorable stimulation without major side effects. This is good when collecting from arthritic bulls.

The advantage of electroejaculation lies in its ability to collect semen without sexual response from the male. Disadvantages to electroejaculation include the cost of the equipment, the possibility of misuse, and coping with the weak cord-probe connection.¹

When collecting a semen sample using the electroejaculation method, the bull should be restrained in a holding facility that resembles natural surroundings as closely as possible. He will respond best if standing naturally. If excitable bulls are to be collected then a squeeze chute may be necessary for efficiency and safety. A conscious effort should be made to provide firm footing for the bull while stimulating him.¹ Open-stanchion type headgate chutes are preferable to those with restraints across under the neck. Following proper restraint of the bull, the preputial orifice should be cleaned and dried before the bull is stimulated. It is recommended that the preputial hair be clipped when the hair is dirty. In addition, the rectum should be emptied of feces before the probe is inserted.¹ It is a good idea to clean the probe between bulls. A bucket of soapy water works well for this task. As the probe is inserted, the ejaculator should be turned on. When insertion is completed stimulation should begin in a rhythmic manner at low power. There should be 2 to 4 seconds of stimulation followed by a one second pause, and again stimulation followed by a one second pause, and the rhythm maintained throughout stimulation until ejaculation is attained.^{5,6} Successively higher power steps are used until ejaculation occurs; about 5-10 stimuli are applied in each power setting. If stimuli are applied correctly, erection and protrusion should occur before ejaculation begins in most bulls.^{1,5} In the normal course of events after application of several stimulations the penis extends itself and clear fluid from the accessory glands drips from the sheath or the extended glans penis. Continued stimulation will cause extension of the penis and spurts of fluid. The fluid will change color to a milky color indicating that the sperm rich fraction is beginning. It is at this time that the collection funnel should be placed directly over the glans

penis and remains there during the further rhythmic stimulations until the fluid being collected begins to turn clear again.⁵

Angus bulls usually extend their penis when the probe is being inserted but will retract it upon initial stimulation at the low power setting. Brahman bulls may lie down when first stimulated even at the low power setting.⁵ Caution must be exercised when samples are to be obtained from these bulls.

If the bull fails to protrude its penis as it is electroejaculated, the person that is positioning the probe can push forward on the sigmoid flexure and mechanically extend the penis in many instances. However, pressure should not be applied to the sigmoid flexure before the penis is erect because this may interfere with erection in some bulls.¹

Although poor sperm production capacity has been linked to abnormally small testes, poor response or faulty technique in the collection process should be suspected when the testes are normal in size yet no semen sample is obtained.¹

The final step in a complete breeding soundness examination involves the evaluation of the semen sample and final scoring of the bull using the BSE criteria. To conduct a thorough examination of the semen, certain equipment is a must. This equipment includes: 1) a microscope equipped with a 1000x oil immersion lens, 2) slide and microscope stage heater, 3) a waterbath set at 37 degrees Centigrade, 4) eosin-nigrosin stain, 5) fresh diluting solution such as physiologic saline or phosphate buffered 2.9% sodium citrate, 6) a "3" plate laboratory counter, and 7) microscope slides and coverslips.⁶ It should be kept in mind that all surfaces with which the semen has contact must be warm (39 degrees C) and free from water or chemicals that may be toxic to spermatozoa.⁶

The actual evaluation of the semen sample involves two general categories. The first category is motility and the second is morphology.

Motility is that proportion of spermatozoa actively moving forward.⁶ Motility may be adversely affected by: poor spermatogenic function, abnormal function of the duct system, the presence of foreign material (e.g. leukocytes), recent sexual rest, poor collection techniques, and environmental factors such as water and/or urine in the sample or cold shock.

To make a motility estimation, a small drop of raw semen is mixed with a small drop of warm physiologic saline or 2.9% sodium citrate diluent buffered to a pH of 6.8-6.9 with phosphate buffers.¹ Good semen diluents can usually be obtained from bull studs. Once mixed, a cover slip is applied. For estimation of gross motility a drop

of raw undiluted semen can be placed on the other end of the same slide. The slide is placed in a slide warmer and viewed under high power (400x). The rate and percent of progressively motile spermatozoa are evaluated. For breeding soundness purposes it is classified into four categories. 1) Very good semen moves rapidly and in a straight line. In this kind of semen sample a "swirling" phenomenon is seen which moves across the slide in a linear fashion. 2) Good semen has the same linear movement, but moves slower, 3) Fair semen motility moves slowly and is somewhat erratic in direction of movement. 4) Poor semen is motionless or only sporadic in its movement.¹ Evaluation of semen motility should be made soon after the collection of the sample and only under carefully controlled conditions of environment and dilution to maintain optimum repeatability. All tubes and surfaces should be at body temperature (37° C).¹

The concentration or density of a semen sample may be estimated visually: 1) Very good semen is usually thick, creamy and viscid. 2) Good semen is a creamy white color. It is less viscid, and is estimated that between 500 million to 1 billion cells per milliliter of semen are in the sample. 3) Fair semen is milky in color, pours freely and contains 250 to 400 million cells per milliliter of semen. 4) Poor semen has a watery gray color and usually contains less than 250 million sperm cells per milliliter.

The prevalence of abnormal spermatozoa in the semen can be determined from a properly stained semen smear examined under the oil immersion lens of a good microscope.¹ An eosin-nigrosin stain is available from the Society for Theriogenology for use as a morphology stain. It has been said that of all the criteria available, a properly done morphology exam has the best correlation to fertility and the highest degree of repeatability, particularly for the field evaluation situation.⁶ The test is set up by placing a drop of stain on the edge of a clear warm glass slide, and the corner of a second slide is dipped into a drop of semen. The stain and semen are mixed for 7 to 10 seconds by bringing the two slides in contact. A smear of this mixture is made by pulling one slide across the top of the other at a 45 degree angle. The stained slide is then allowed to air dry and then examined under oil immersion (1000x). Approximately 100 cells are evaluated from 4 to 5 randomly selected areas of the stained slide.^{1,6} Abnormal cell types are evaluated and placed into two major categories which are called primary sperm abnormalities and secondary sperm abnormalities.

Primary abnormalities are those abnormalities

that are of testicular origin. Presumably something went wrong in the spermatogenic process and was not corrected in passage through the duct system. Primary abnormalities are considered a more severe defect than secondary types.^{1,4,5} If primary sperm abnormalities exceed 18 to 20% a reduction in fertility is likely to occur.¹ Under the primary classification the following abnormalities can be expected: acrosomal defects, abnormal head shapes, proximal droplets, midpiece abnormalities (double or abaxial), and proximally coiled tails.^{1,4}

Secondary abnormalities are thought to occur as the sperm traverse the efferent duct system or during ejaculation. This classification includes defects that result from faulty epididymis function.^{1,4,5} Secondary abnormalities fluctuate more than primary abnormalities and excessive numbers are also associated with poor reproductive performance.¹ Under the secondary classification the following abnormalities are noted: distal cytoplasmic droplets, detached normal heads, and simple bent tails.^{1,4}

The percentage of tail abnormalities generally increases as sperm pass through the excurrent duct system. This suggests that an increase in occurrence of tail abnormalities in the ejaculate may be the result of epididymal dysfunction.¹ As a point of interest, coiled tails are the most common abnormality of the tail.⁴

There are other cell types that occasionally appear in the ejaculate. Red blood cells are seen with urethral lesions and are toxic to sperm cells. Spheroids are immature sperm cells that have been released prematurely from the Sertoli cells. These cells are quite variable in size, and are attributed to testicular insult whether that be heat, cold or trauma. White blood cells are often seen in cases of seminal vesiculitis or orchitis. They have a toxic effect on sperm cells and may cause a drastic reduction in fertility. These cells can be identified by visualization of the nucleus and by their uniform round shape.⁴

Increased morphological abnormalities are evidence of degenerative change of the reproductive tract.¹ One condition which causes a temporary increase in morphological abnormalities of sperm and a consequent decrease in fertility is heat stress. Abnormal sperm will usually appear in the ejaculate approximately two weeks after the heat stress period and will continue to increase until about 61 days for spermatogenesis plus an additional 10-12 days for passage of the sperm through the epididymis. Another way to state this is that semen that is collected today was produced 71-73 days earlier.^{1,4}

Scoring the BSE

The maximum scores assigned for each semen

quality criterion are 20 points for motility, 40 points for morphology and 40 points for scrotal circumference. Bulls are classified as having satisfactory semen if they score 60 or more total points. If the score is between 30 to 60 the bull is considered to have questionable semen quality. If the score falls below 30, the bull is said to be unsatisfactory as a sire.¹ When grading morphology one must remember that a bull which has a high sperm cell output can have a higher number of abnormal cells and still be fertile when compared to a bull with a lower sperm cell output with the same percent of abnormal cells. Also note that the scrotal size is dependent on the age of the bull. The older the bull (5-7 years and up) the less the correlation existing between semen production and scrotal circumference.⁴

Finally, when scoring the bull for breeding soundness any physical condition that was abnormal and might interfere with proper breeding ability should, depending on the seriousness of the problem, place the bull in a questionable classification.¹

Conclusion

In conclusion the veterinarian should have a logical approach to male reproductive problems. This approach should include proper observation and measurements, the interpretation of data in terms of normal versus abnormal reproduction systems, decisions about the site and severity of any dysfunction, to what degree the dysfunction will affect fertility, the consideration of a genetic involvement and finally the formulation of a prognosis.⁶ The breeding soundness examination is an extremely useful tool in attempting to measure a bull's potential to cause conception if a systematic approach is implemented and a competent professional, who is well versed in the anatomy, physiology and pathology of the bovine reproductive tract is in charge of conducting the examination.

REFERENCES

1. Ball L, Mortimer RG, Ott RS, Simons JC: *Journal of the Society of Theriogenology*. Vol XII. Society for Theriogenology. pp. 1-56. 1983.
2. Bohlender R: Beef Cow and Calf Herd Health Management. In: Howard JL (ed.): *Current Veterinary Therapy*. Philadelphia: W.B. Saunders Company. p. 149. 1986.
3. Blood DC, Radostits OM: *Herd Health*. W.B. Saunders Company. pp. 209-211. 1985.
4. Notes from VCS 450 Theriogenology, Dr. Hopkins, Fall, 1984.
5. Sorenson AM: *Animal Reproduction Principles and Practices*. New York: McGraw-Hill Company. pp. 85-143. 1979.
6. *The Merck Veterinary Manual*. Rahway: Merck & Co. Inc. pp. 801-80. 1979.