Breeding Soundness Evaluation of Bison Bulls

Putting Science and Practicality in Perspective

Colin Palmer DVM, MVSc, DACT
Western College of Veterinary Medicine

Male Fertility
Salient Points

The sire is responsible for 50% of the offspring production equation.

The fastest, most efficient way to achieve genetic gain in a herd is through sire selection …

If retaining replacements, within a few short years selected bulls can be responsible for over 80% of the genetic makeup of the bull.

- Determining the fertility potential of a male through a **breeding soundness evaluation (BSE)** is at least as important as any other agricultural service.

… it really does take more than 1 sperm!!

The Importance of Bull Fertility

Beef Cattle Goals:

- 365-day calving interval
- Majority of cows bred during 1st 2 heat cycles

✓ 60-day Pregnancy Rate - > 95%

✓ First 20-day Pregnancy Rate - > 65%

Bison Goals:

- 365-day calving interval
- Majority of eligible cows bred during the 1st 2 heat cycles

✓ 60-day Pregnancy Rate (cow's exposed to bulls) - ??

✓ First 20-day Pregnancy Rate (cow's exposed to bulls - ??

Breeding Soundness Evaluation (Examination)

- An evaluation of an animal to determine their potential to be a successful breeder within accepted, industry parameters.
  - It is used to identify the more fertile animals, but is not a guarantee that an animal will breed successfully.

Bison Bull to Female Ratio
1:20 to 1:25

Breeding Soundness Evaluation

To be satisfactory potential breeders

all bulls must:

1. Be **physically sound**
2. Be able to **complete service**
3. Have satisfactory **semen quality**

Breeding Soundness Evaluation should always be more than just a semen check!!

How to Evaluate Physical Soundness

- Conformation of the feet and legs – visual appraisal
  - Watch the bull walk!
- General health
  - Body condition score
- Examination of scrotum and its contents
  - **Scrotal circumference**
- Transrectal internal examination

Examination of Scrotum and its Contents

Testicles Produce:

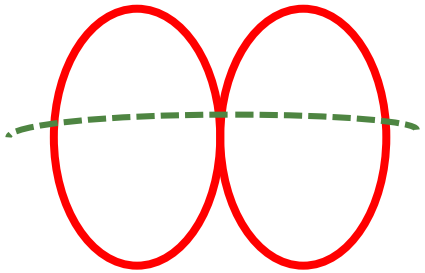
1. Testosterone – Male characteristics, libido
2. Sperm –

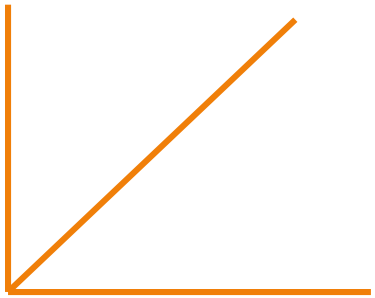
   In mature bulls e*ach gram of testicular tissue produces 17 million sperm per day (Bos taurus) – likely similar for Bos bison.*

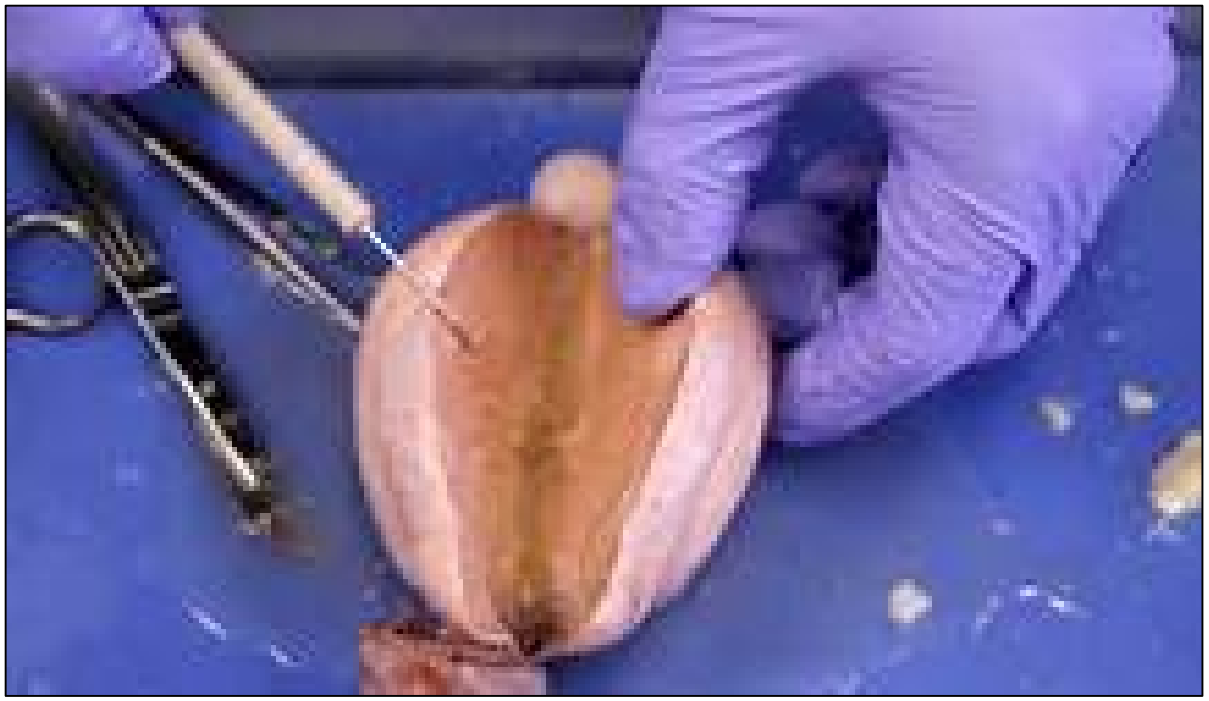
Scrotal Circumference
What Does it Mean?

- A very close relationship exists between:

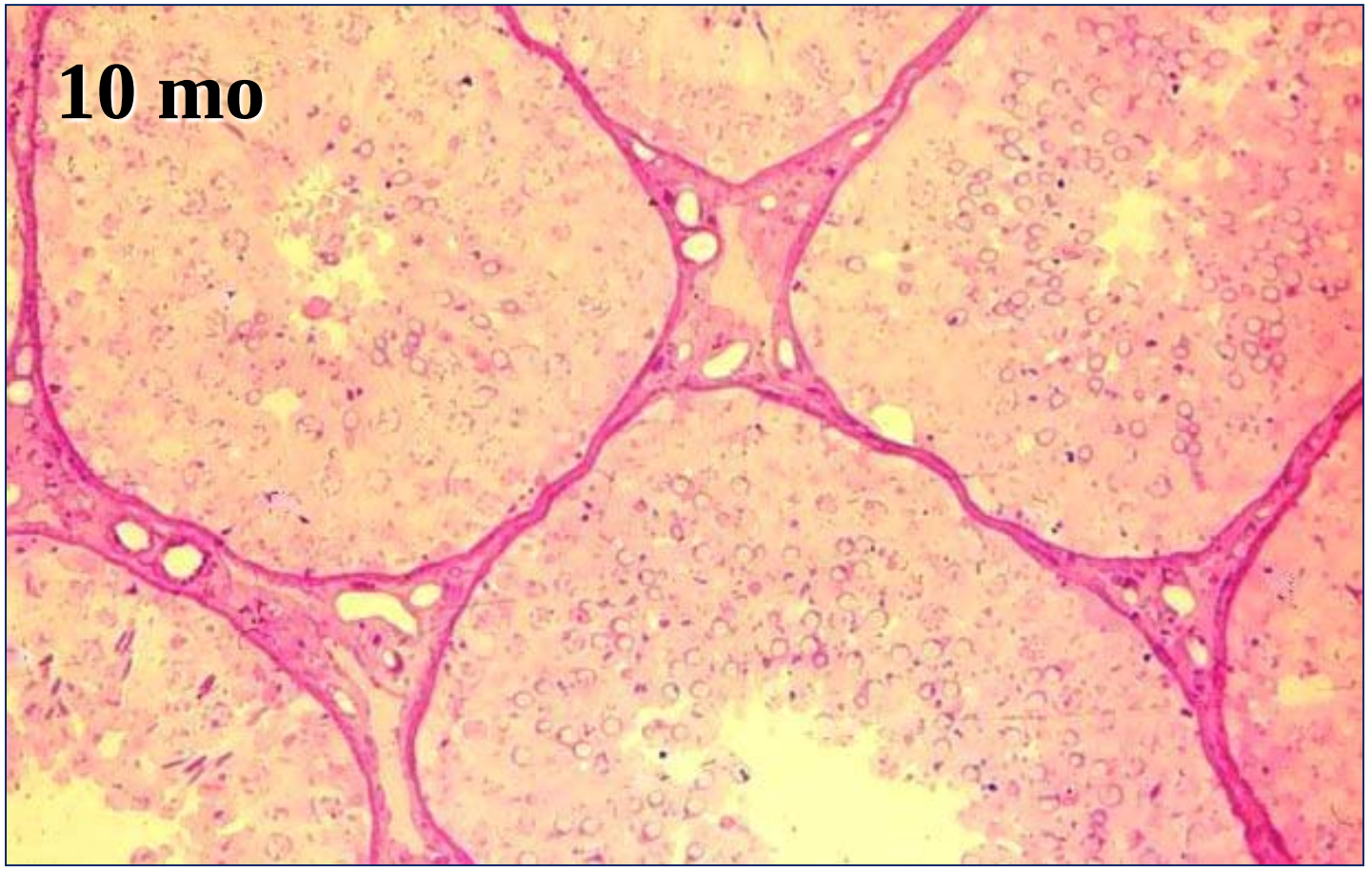
Testicular Development – Paired Testis Weight – Scrotal Circumference



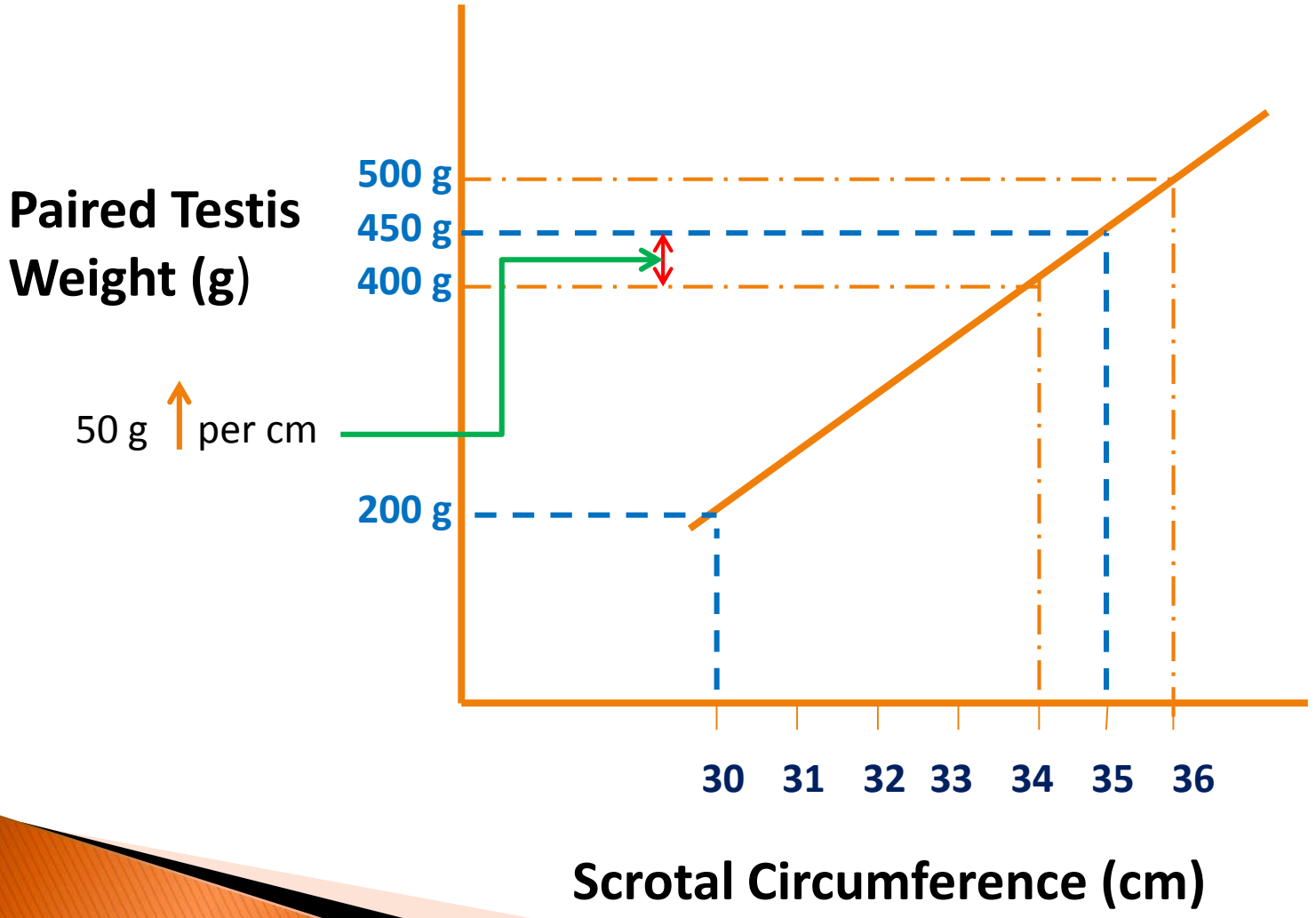




Split Testicle


10 mo

Paired Testis Weight – Scrotal Circumference



The effect of just a few cm...

- 34 cm ----- 400 g of testis
- 30 cm ----- 200 g of testis

34 cm	400 g
- 30 cm	- 200 g
4 cm	200 g

400 / 200 = 2

Twice as much testicle = Twice as much sperm

How about 30 vs. 38 cm ...

3 X

Bigger Testicles Produce More Sperm!!

Scrotal Circumference

SC may be a better indicator of onset of puberty (in cattle) than age or weight regardless of breed

Lunstra et al. 1978, 1982

Scrotal Circumference Bison

- Scrotal circumference was positively correlated with body weight, with percentage of normal sperm and percentage of motile sperm in bison bulls aged 28 to 30 months examined in October.
- The optimal scrotal circumference was found to be ≥29 cm.
- 65% of bison bulls attained ≥ 30% sperm motility and 70% normal morphology at 28 to 30 months of age = Satisfactory Potential Breeders.

Keen et al. Breeding soundness examinations of North American bison bulls. JAVMA 1999; 214 (8)

Scrotal Circumference in Bison…
Easier said than done!

Suggestions??

There must be other ways to evaluate scrotal size and estimate paired testis weight?

More studies focused on testicular size and development in bison bulls are needed…

Puberty

- Onset of puberty in bison bulls occurs when the ejaculate contains 50 x 10^6 sperm displaying at least 10% progressive motility
  - Puberty does not equal sexual maturity
- Bison bulls reached the onset of puberty at 16.5 months with a range of 14 to 21 months.
  - Body weight had a significant effect on age at puberty
    - Mean body weight at puberty was 353 ± 52.8 kg

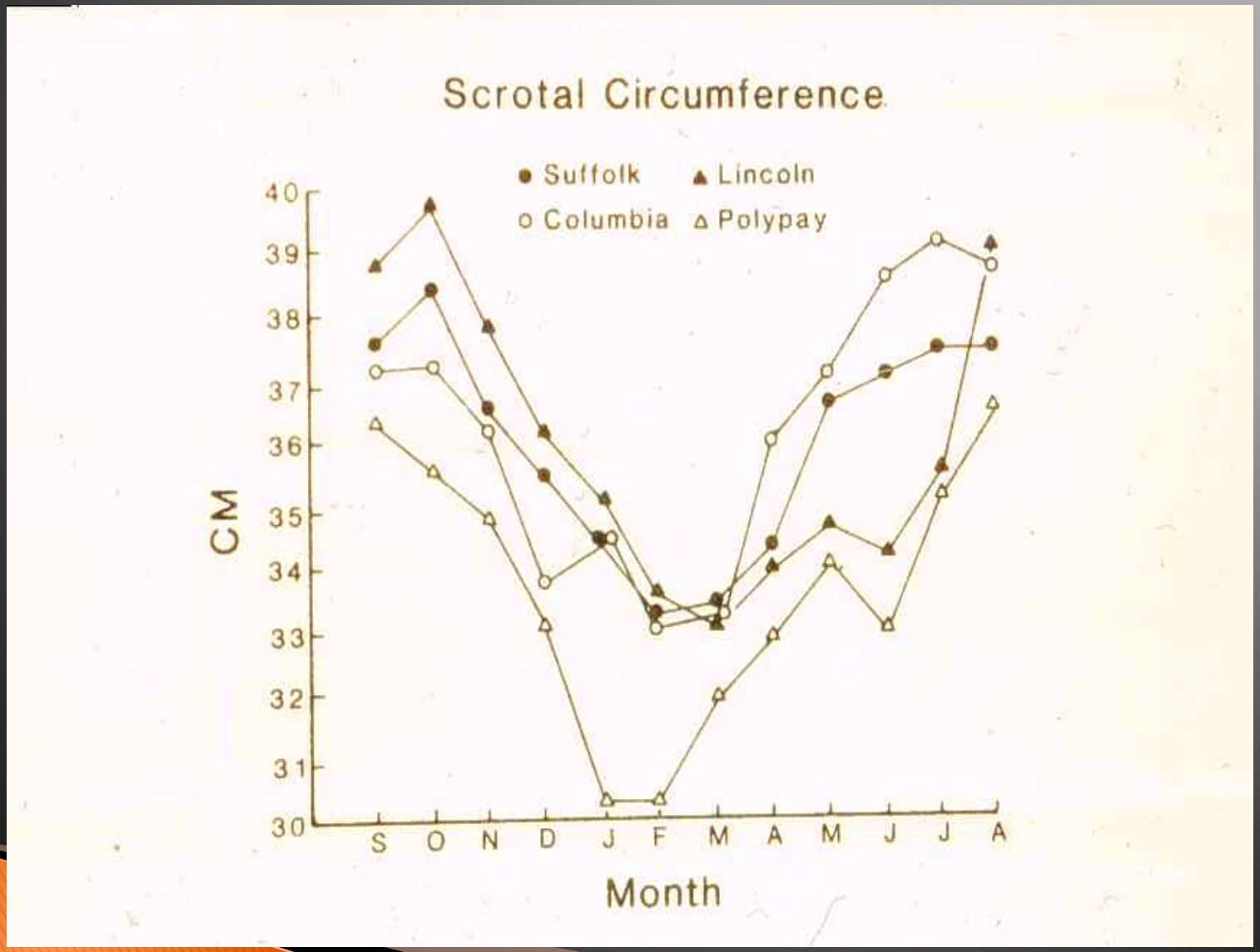
Helbig L. Onset of Puberty and Seasonal Fertility in Bison (Bison bison) bulls. Master of Science Thesis 2005, University of Saskatchewan.

When Should Young Replacement Bulls Undergo a Breeding Soundness Evaluation

- Most bison bulls should be sexually mature enough to pass a breeding soundness evaluation by 24 months of age (Helbig L, 2005)
- Is it ok to evaluate younger bulls?
  - Based on work in beef bulls – yes
    - However, avoid condemning immature bulls before 24 months of age!
    - Beef bulls that have adequate scrotal circumference at 10 months of age will have scrotal circumference ≥ 12 months of age; but bulls with smaller scrotal circumferences at 10 months can catch up and be satisfactory at ≥ 12 months.

Scrotal Circumference and Season

Rams

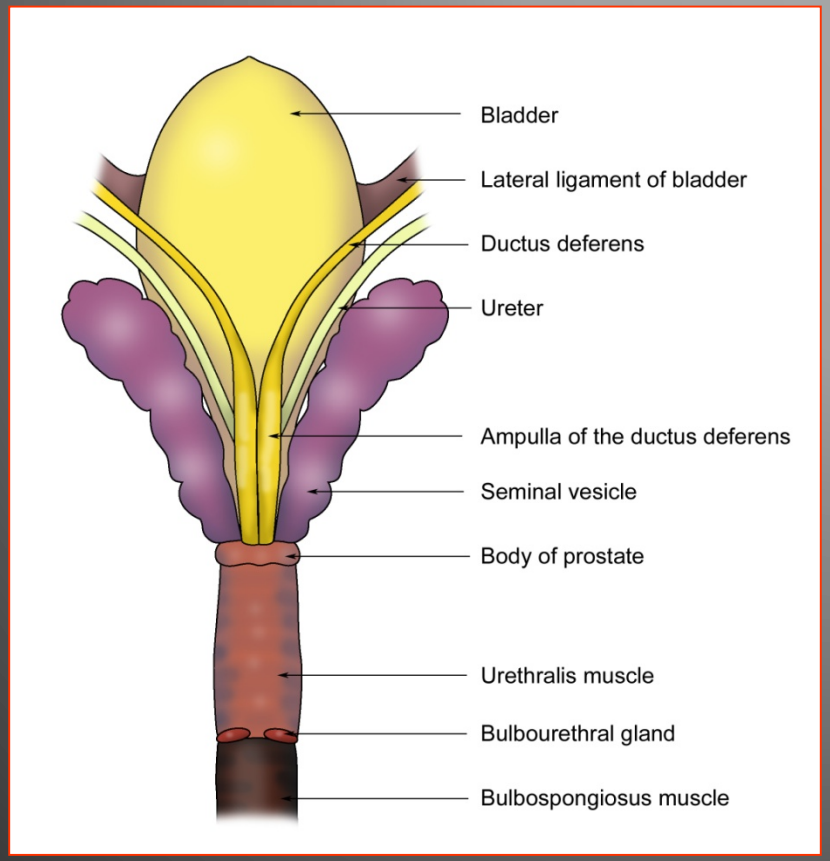


Seasonality

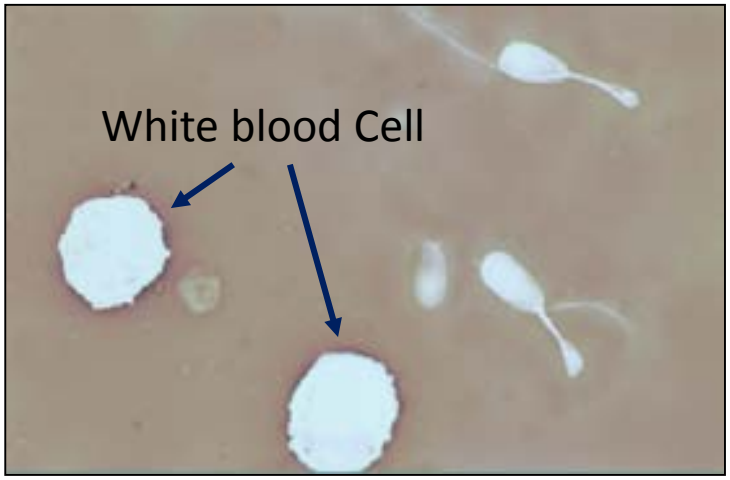
- Bison fertility is less seasonal than sheep, horses or deer, but more than cattle.
- Traditional breeding season is July to October, but calves are uncommonly possible in every month of the year.
- Testes weight increased in the summer (Helbig, 2005)
- There were fluctuations in semen quality throughout the year and an increase in testosterone production before the breeding season.

Helbig L. Onset of Puberty and Seasonal Fertility in Bison (Bison bison) bulls. Master of Science Thesis 2005, University of Saskatchewan.

Internal Examination



Seminal Vesiculitis

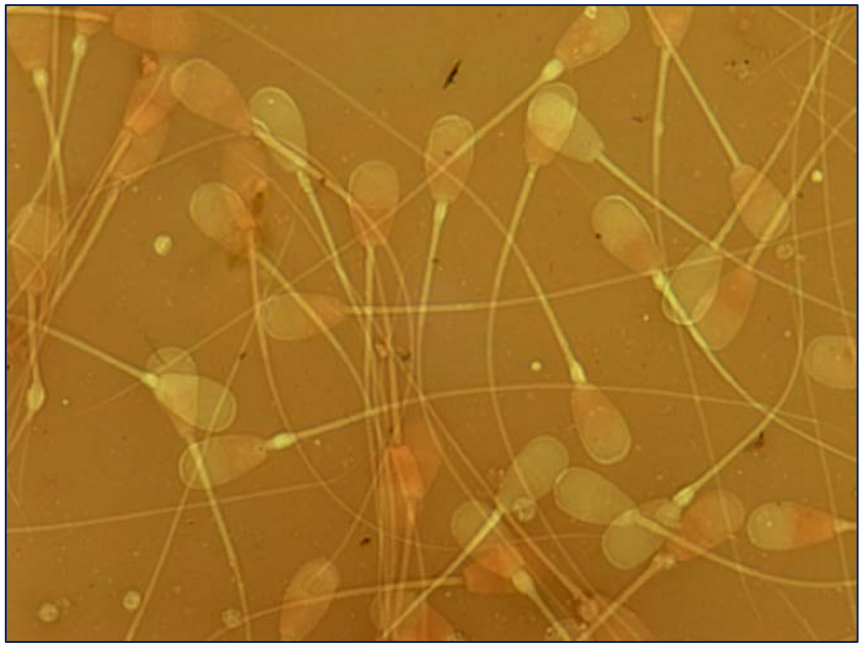


Fortunately seminal vesiculitis is not common in bison bulls, but has been reported in association with Brucella abortus infection.

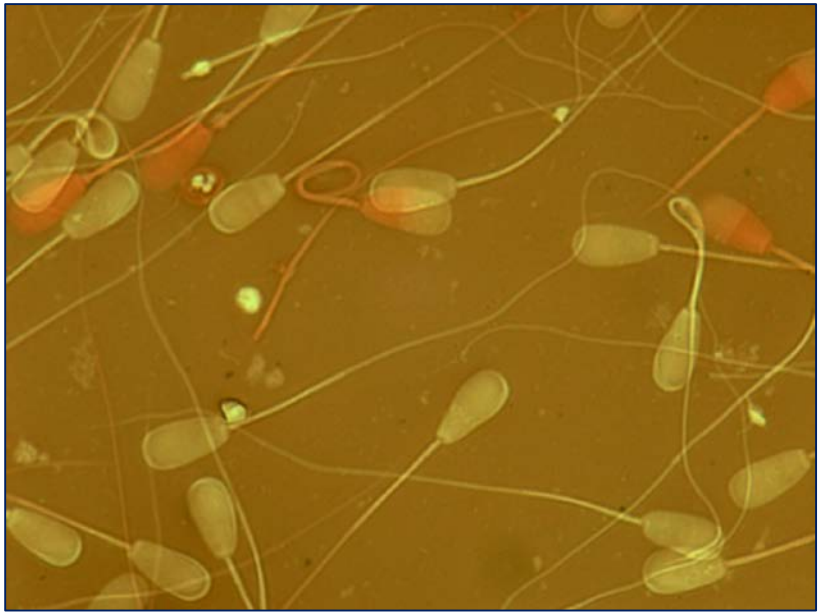
Evaluation of Semen

- Concentration
- Motility
- Percentage Live
- **Morphology**

Sperm Morphology

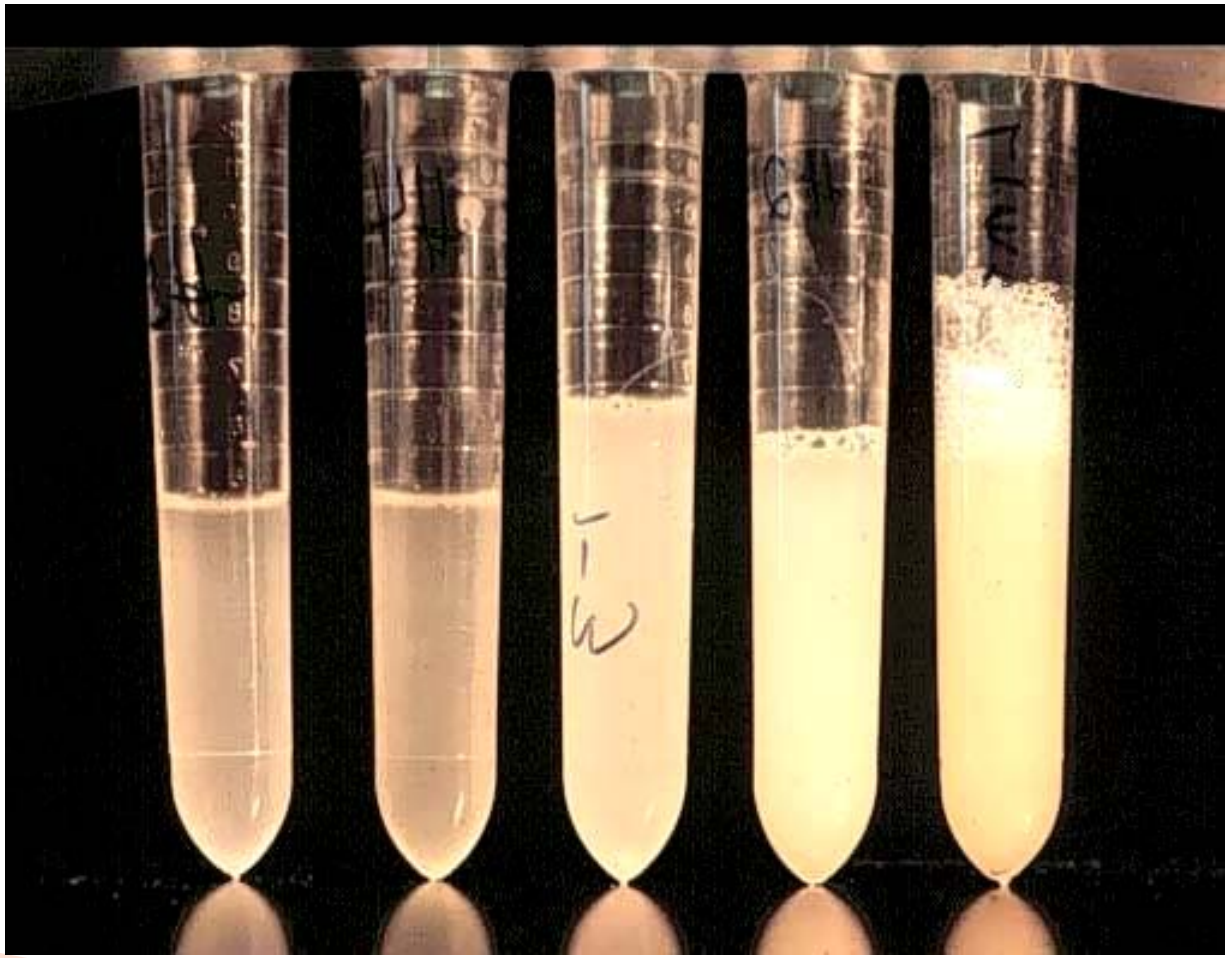


Proximal Droplets



Nuclear Vacuoles

Concentration



Considerations

- Scrotal circumference and sperm morphology are the two best indicators of potential fertility
  - A safe alternative to scrotal circumference is needed
- Puberty occurs much later in bison compared to cattle; therefore, breeding soundness should be delayed until the animal is at least 24 months of age.
- More research is needed to clarify the effect of season on semen quality in bison.

Questions??