Herd fertility management

By

Professor Dr. Fekry Hussein

Faculty of Veterinary Medicine Alexandria University

(3)

- For the optimal Production of both milk and calves, the target is generally for every cow in herd to produce alive healthy calf each year, i.e. to have a calving interval of 365 days.

- Many modern professional periodicals raise the question of whether a longer calving interval might benefit reproductive performance, especially in dairy cows, allowing longer for both energy resources and reproductive processes to be restored post partum.

- In spite of clear evidence that greater insemination efficiency is usually achieved around 70-90 days post calving than immediately following the voluntary waiting period,

- late breeding is generally not economically feasible in dairy and seasonal beef operations.

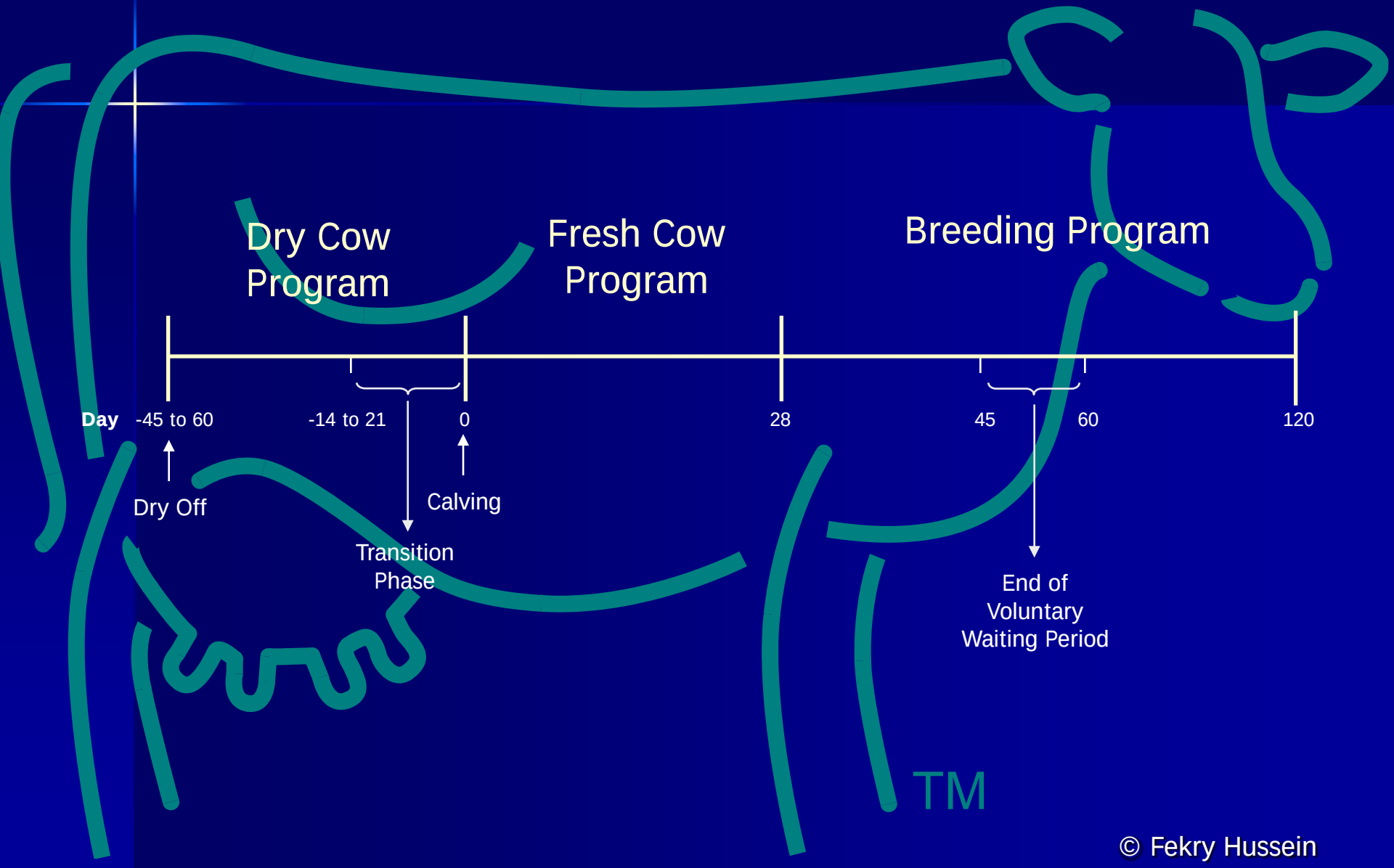
- The control of reproduction in the dairy herd is only one component of the whole farm management package, which should be the preserve of the veterinary practice .

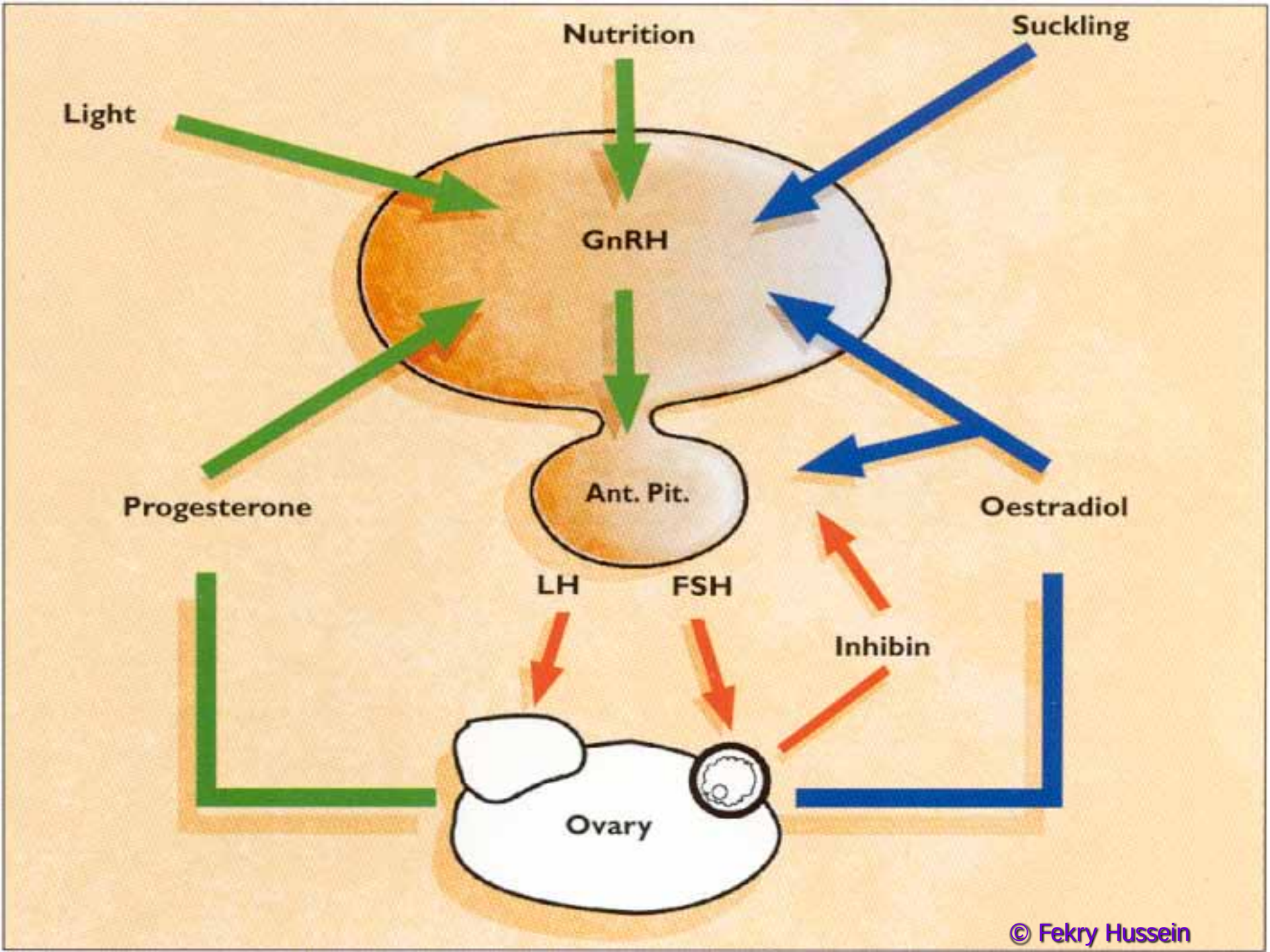
- Reproductive performance of a dairy farm affects profitability directly through the milk production per cow per day, the number of replacements available, and voluntary and involuntary culling rates.

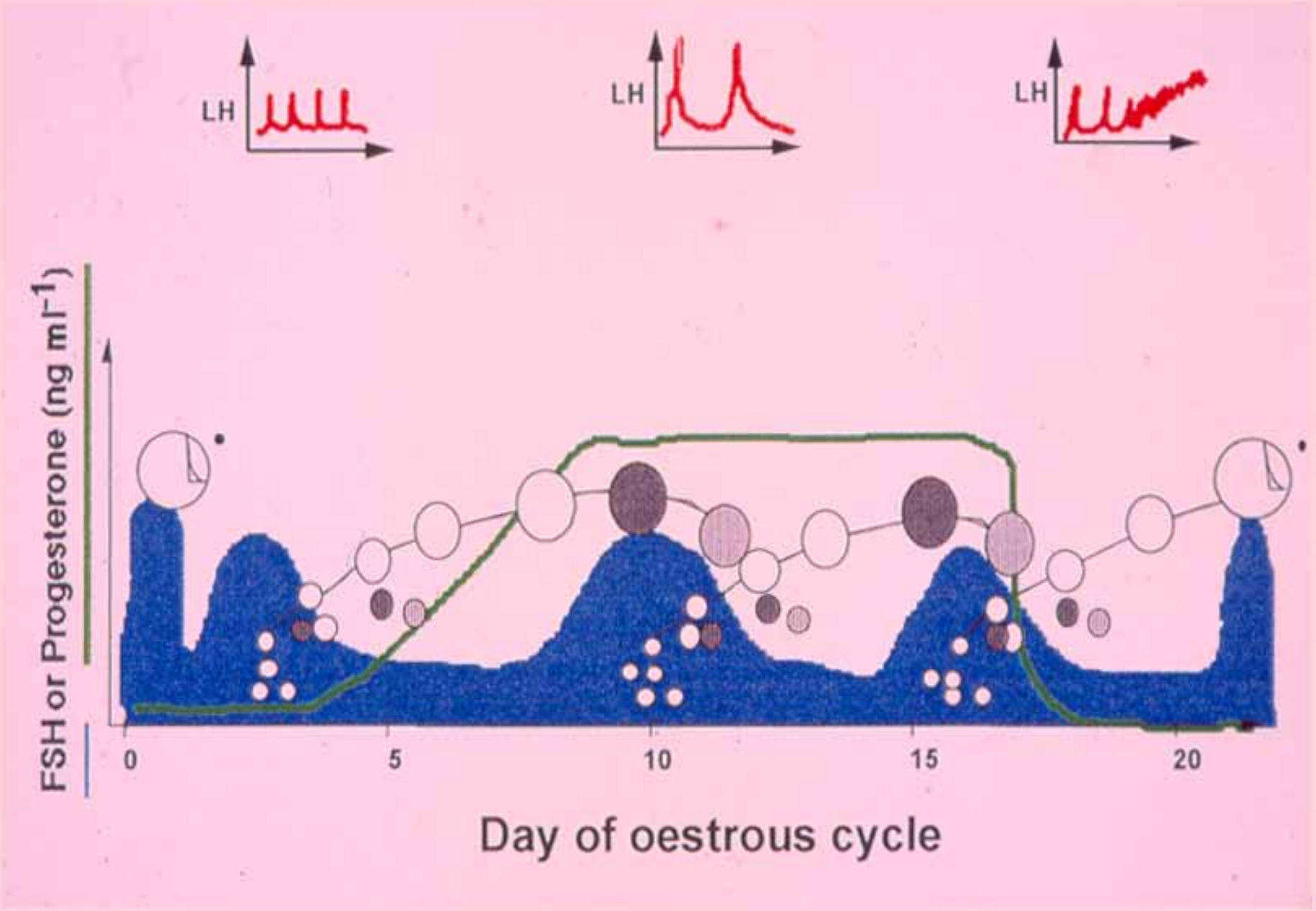
- It is important to recognize that reproductive management programs will differ because of varying on-farm costs, housing and handing facilities, farm targets and values, and management styles.

- Communicating, to the farmer, the value of the cost-benefit of veterinary services is a key feature for the success of herd health programs.

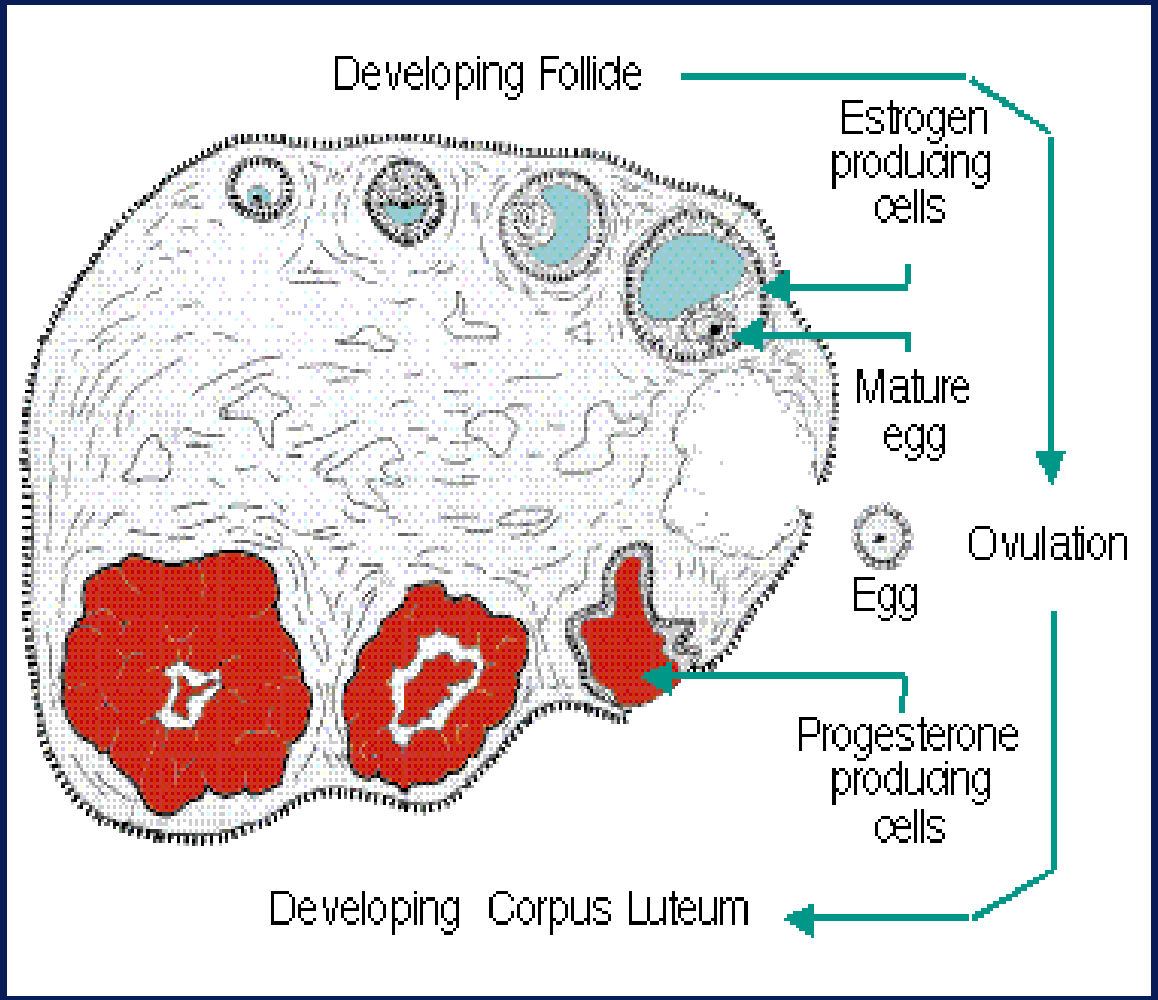
100-Day Contract







Ovarian structures through the estrous cycle



Evaluation of fertility

Table 1 lists the parameters and targets commonly used to analyze and evaluate fertility in the dairy herd.

Parameter	Target
Calving-conception interval (av. Number of days open)	< 90 days
Calving -1st insemination Interval	< 70 days
Conception rate at 1st insemination	> 60 %
Number of inseminations per conception	< 1.5
Abortions (between 42-265 days of pregnancy)	< 3%
Culling due to infertility	< 5%
Age at first calving	24 months

Economic aspects

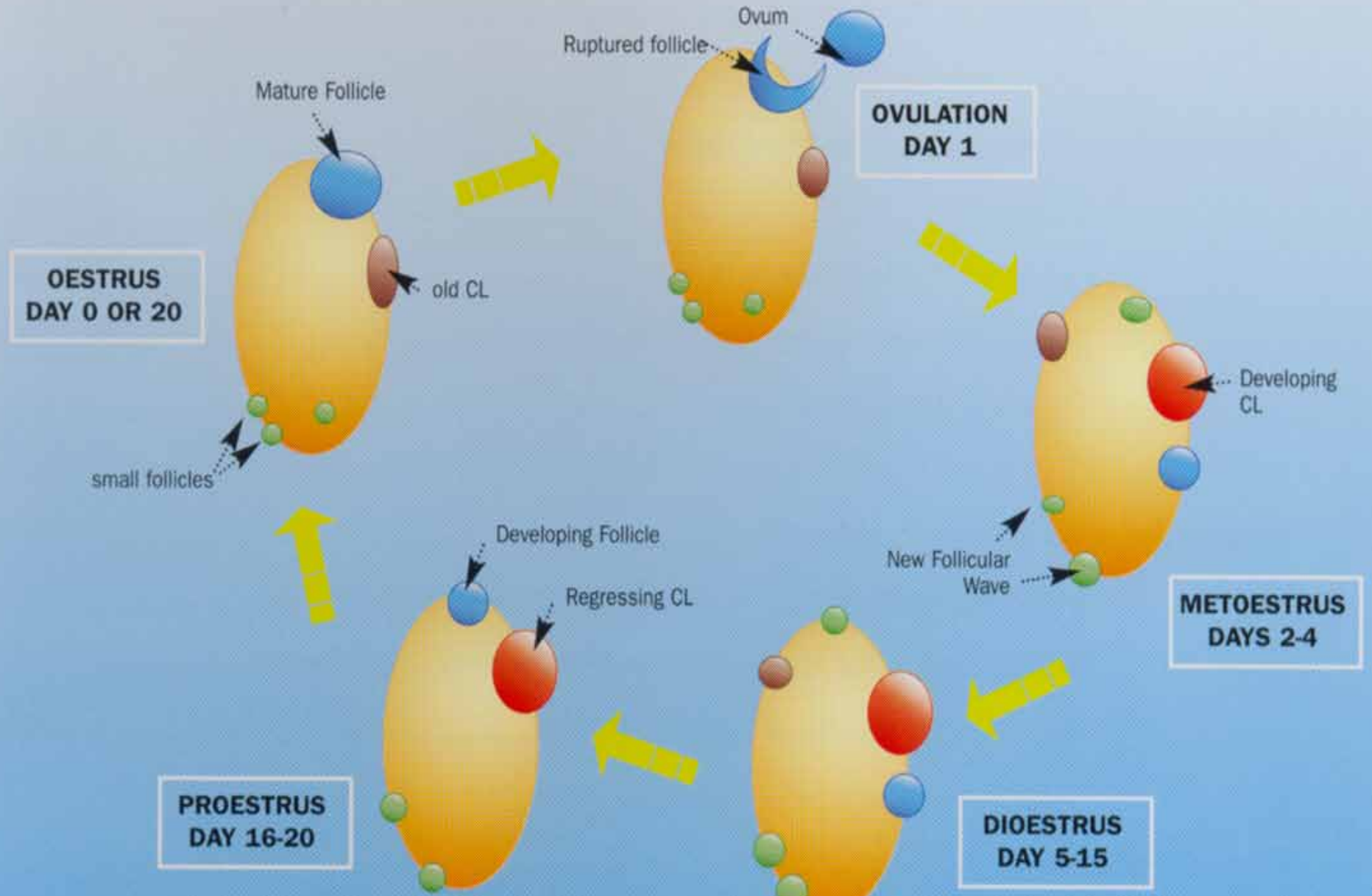
There are three main components of economic loss due to fertility problems:

- Losses due to incorrectly timed or ineffective AI
- Extended calving intervals
- Culling for reasons of reproductive failure of animals with high genetic potential

Losses due to incorrectly timed AI

- Endocrine disorders affective performance in cattle often manifest themselves in the irregularity of the oestrous cycle, inadequate signs of heat or delayed ovulation.

- The result is likely to be the incorrect timing of artificial inseminations increase the costs of service and are wasteful of semen.


Ovum
Ruptured follicle
Mature Follicle
OVULATION
DAY 1
OESTRUS
DAY 0 OR 20
old CL
Developing
CL
small follicles
New Follicular
Wave
METOESTRUS
DAYS 2-4
Developing Follicle
Regressing CL
PROESTRUS
DAY 16-20
DIOESTRUS
DAY 5-15

Oestrus control is used in dairy cattle for the following indications:

To induce estrus and ovulation in cows with post partum anoestrus in order to shorten the interval between calving and first insemination.

To synchronize donor and recipient cows for embryo transfer.

To synchronize estrus in groups of animals to improve estrus detection or to reduce the time required for estrus detection.

To control a herd's calving period.

In cattle with active ovaries, the estrous cycle can be manipulated in three ways:

By the use of prostaglandins, to induce early regression of the corpus luteum.

By the sequential use of prostaglandins and GnRH analogues to obtain synchronized follicular development after an induced luteolysis.

By the use of progestagens that act as an ‘artificial’ corpus luteum.

In animals in anoestrus (failing to ovulate), systems should be employed that allow for the induction of follicular growth and ovulation followed by a luteal phase of physiological duration:

progestagen-based systems usually combined with GnRH and/or PMSG/eCG.

Stimulation of ovarian activity with GnRH followed by an Ovsynch-type protocol.

1-Factors contributing to fertilization failure:

a. Unfavorable endocrine environment causing impaired follicular growth and poor oocyte quality:

- Heat stress
- negative energy balance
- infection with BVDV and IBRV

b. Ovulation delay and/or failure

- Heat stress
- negative energy balance

c. Factors affecting the quality of spermatozoa.

- Factors affecting spermatogenesis: infections with BVDV, IBRV, Brucella spp., heat stress, fever

- Factors affecting the survival of sperm before deposition in the female reproductive tract: semen preservation technique, semen management.

2-Factors affecting early embryonic development, pregnancy recognition and implantation:

a. Impaired early luteal function

- High metabolic rate in dairy cows
- infection with BVDV and IBRV
- lack of progesterone priming in the first post-anoestrus cycles
- luteotoxic factors causing precocious luteolysis: mycotoxins, bacterial toxins associated with mastitis.

Importance of early luteal function in pregnancy recognition and maintenance.

Progesterone receptor levels

are maximal from day 4 – 10 post ovulation

Endometrial Glands

(synthesize , secrete & transport)

A Complex of amino acids, glucose, transport proteins & Growth factors called histotroph)

sub-epithelial stroma

Histotroph : is an essential source of nutrients & regulatory for the Developing blastocyst in the pre-attachment period

Fertility & milk production are negatively associated in dairy cows .

High yielding cows have lower circulating concentrations of P4 than low yielders .

They may possibly be associated with their higher metabolic rate & consequently higher rate of P4 catabolism.

3-Factors causing late embryonic/fetal death:

Infectious factors directly detrimental to the fetus or impairing the function of the placenta:

- viral infectious : BVDV and IBRV
- bacterial infectious : brucella spp., Chlamydia spp.

Or

impairing the function of the placenta

- mycotoxins,
- certain substances such as: PVP, lead etc..

The detrimental effect of high ambient temperatures on reproductive processes in dairy cattle has been well documented and includes:

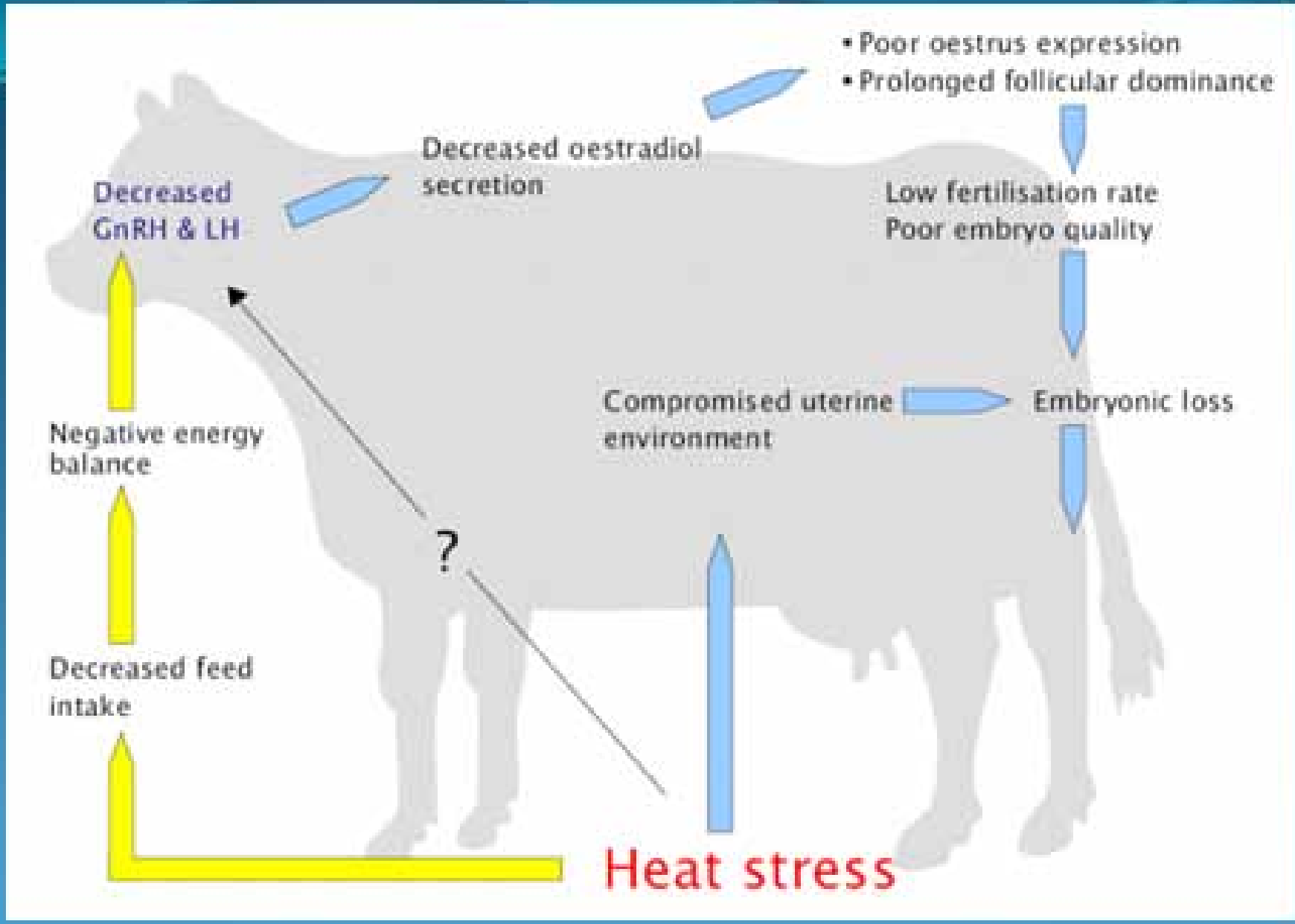
Negative effect on reproductive behavior patterns.

Impaired endocrine interactions .

Changed follicular development pattern.

Decreased quality of oocytes and embryos .

Negative effect on the nutritional status and energy balance.


• Poor oestrus expression
• Prolonged follicular dominance
Decreased oestradiol secretion
Decreased GnRH & LH
Low fertilisation rate
Poor embryo quality
Compromised uterine environment
Embryonic loss
Negative energy balance
?
Decreased feed intake
Heat stress

Improvement of conception rate at and after AI

Pharmacological attempts to improve fertility in inseminated cattle have concentrated on three areas so far:

Timely induction of ovulation.

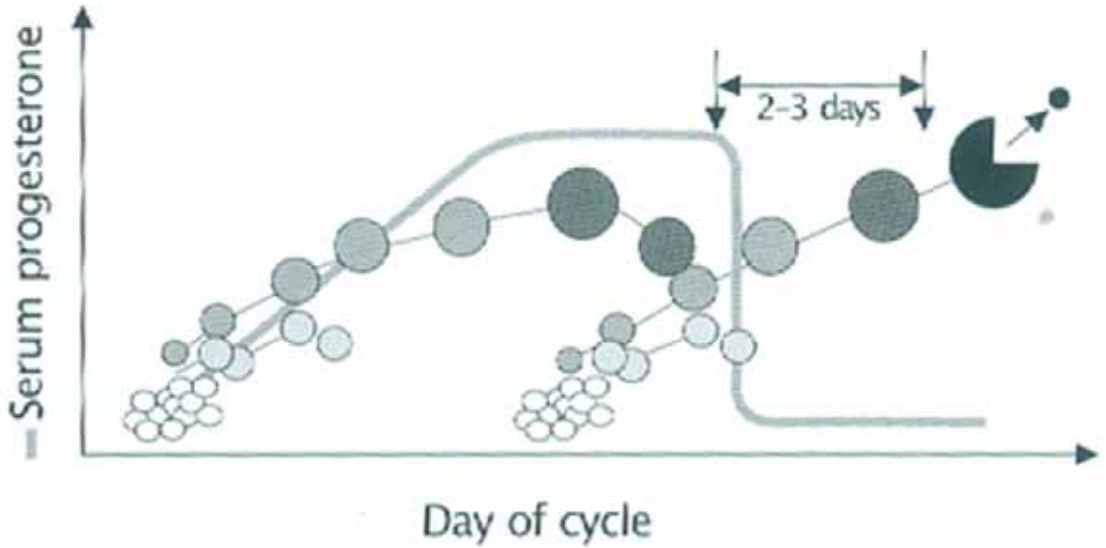
Prevention of early embryonic loss through increasing progesterone concentrations in the general circulation or prevention of precocious luteolysis.

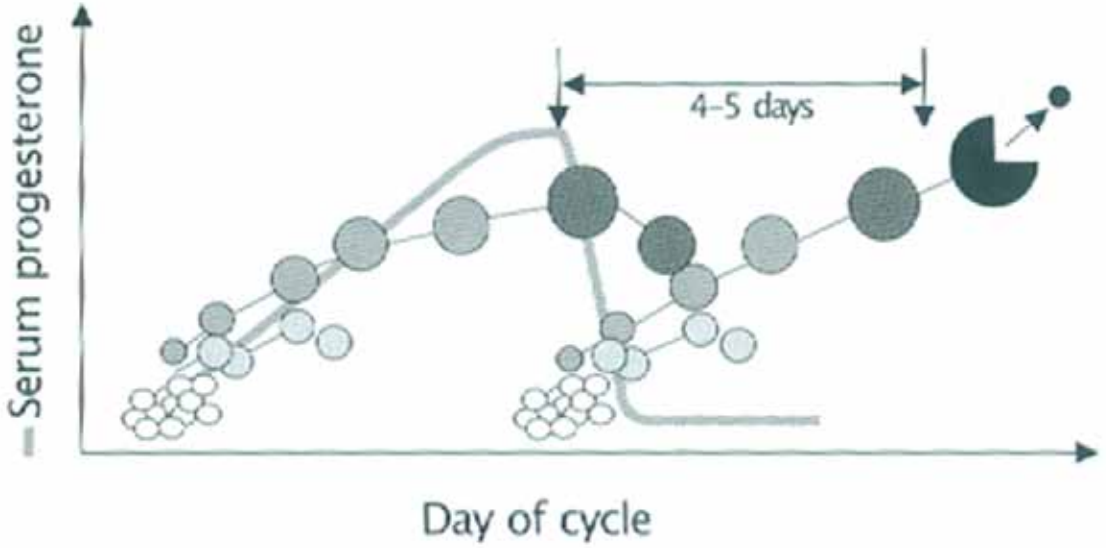
Minimizing the reproductive effects of heat stress .

b. Impaired function of endometrium and unfavorable uterine environment

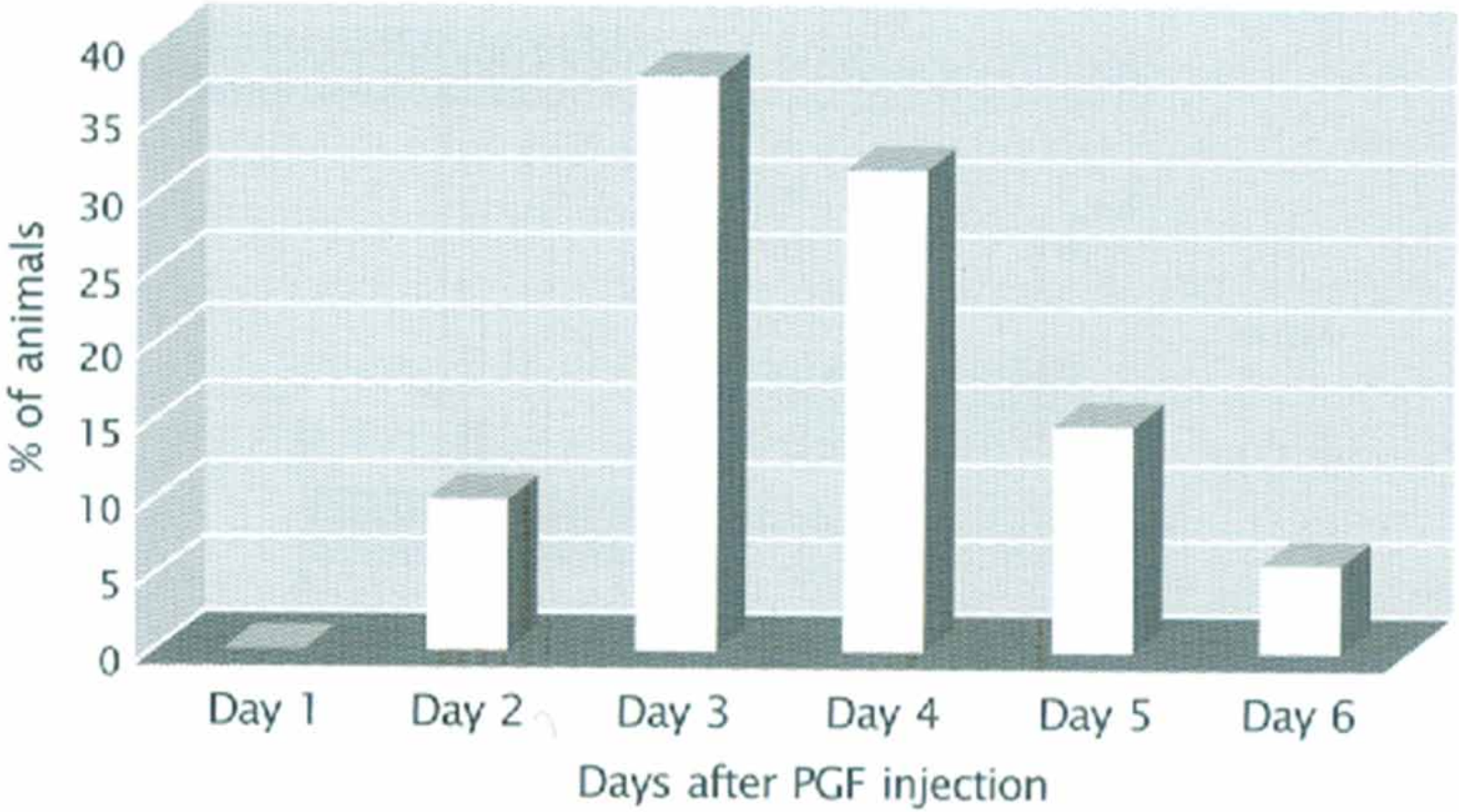
- increased levels of plasma urea nitrogen
- subclinical endometritis

Interval from PGF injection to ovulation in cattle



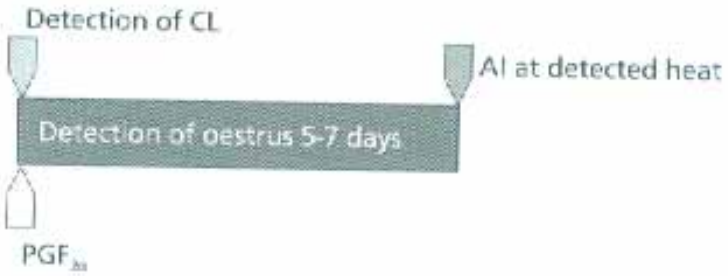


Distribution of oestrus in cows treated with PGF

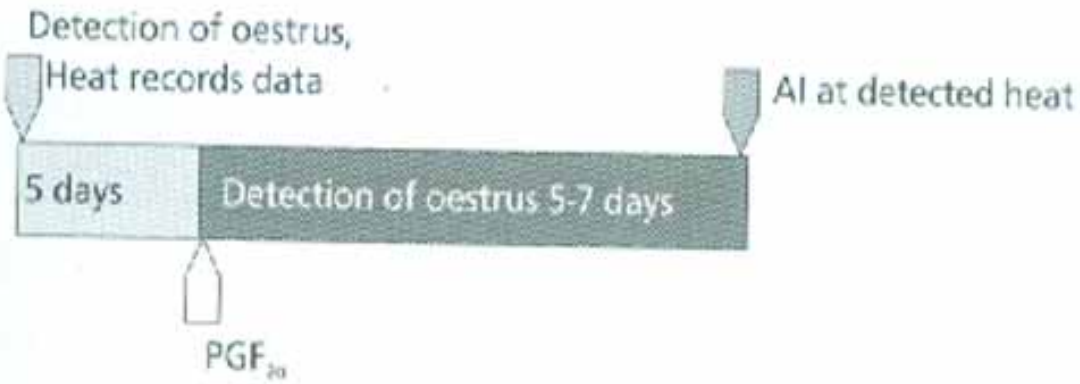


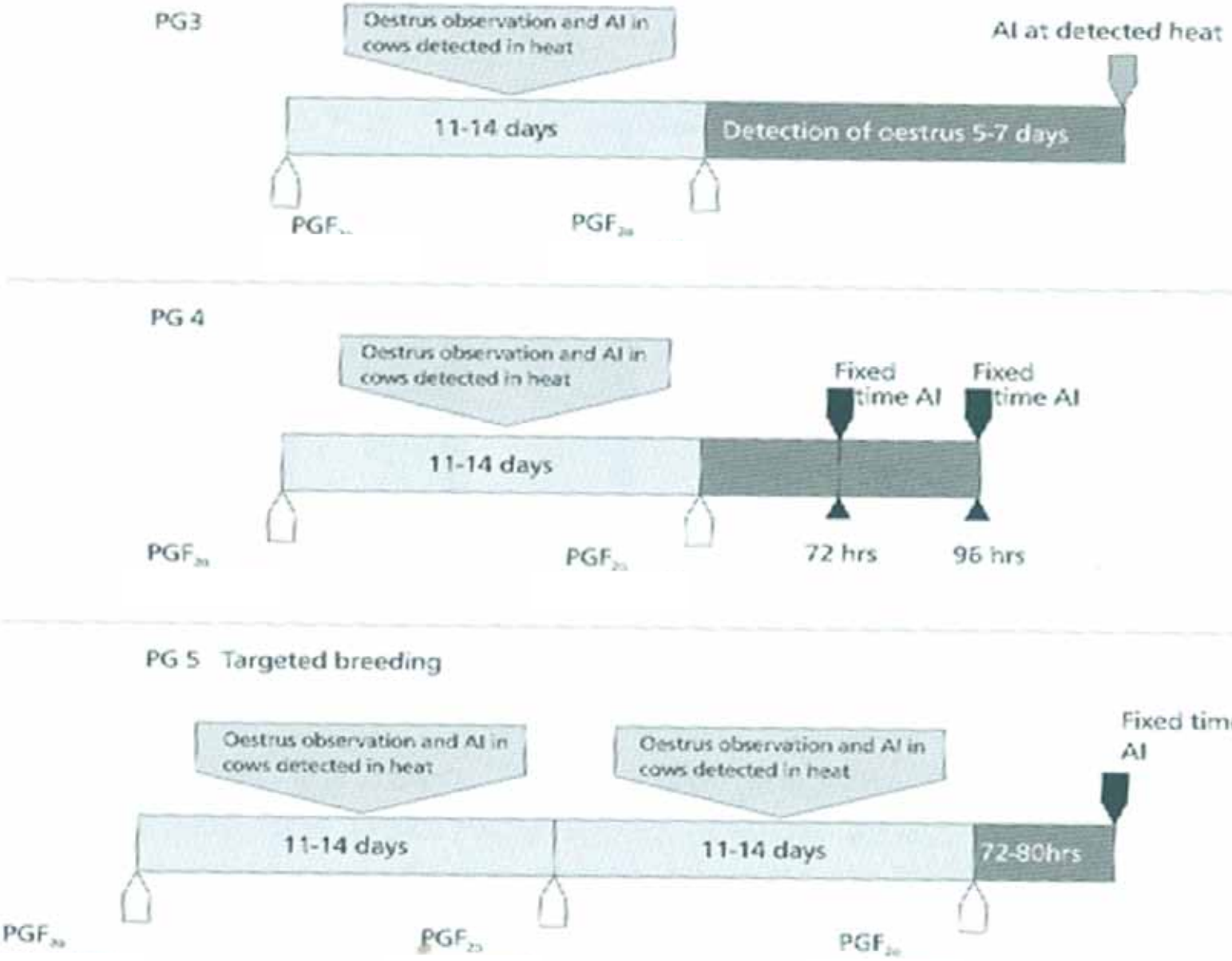
Various systems of oestrus management with prostaglandins

PG1

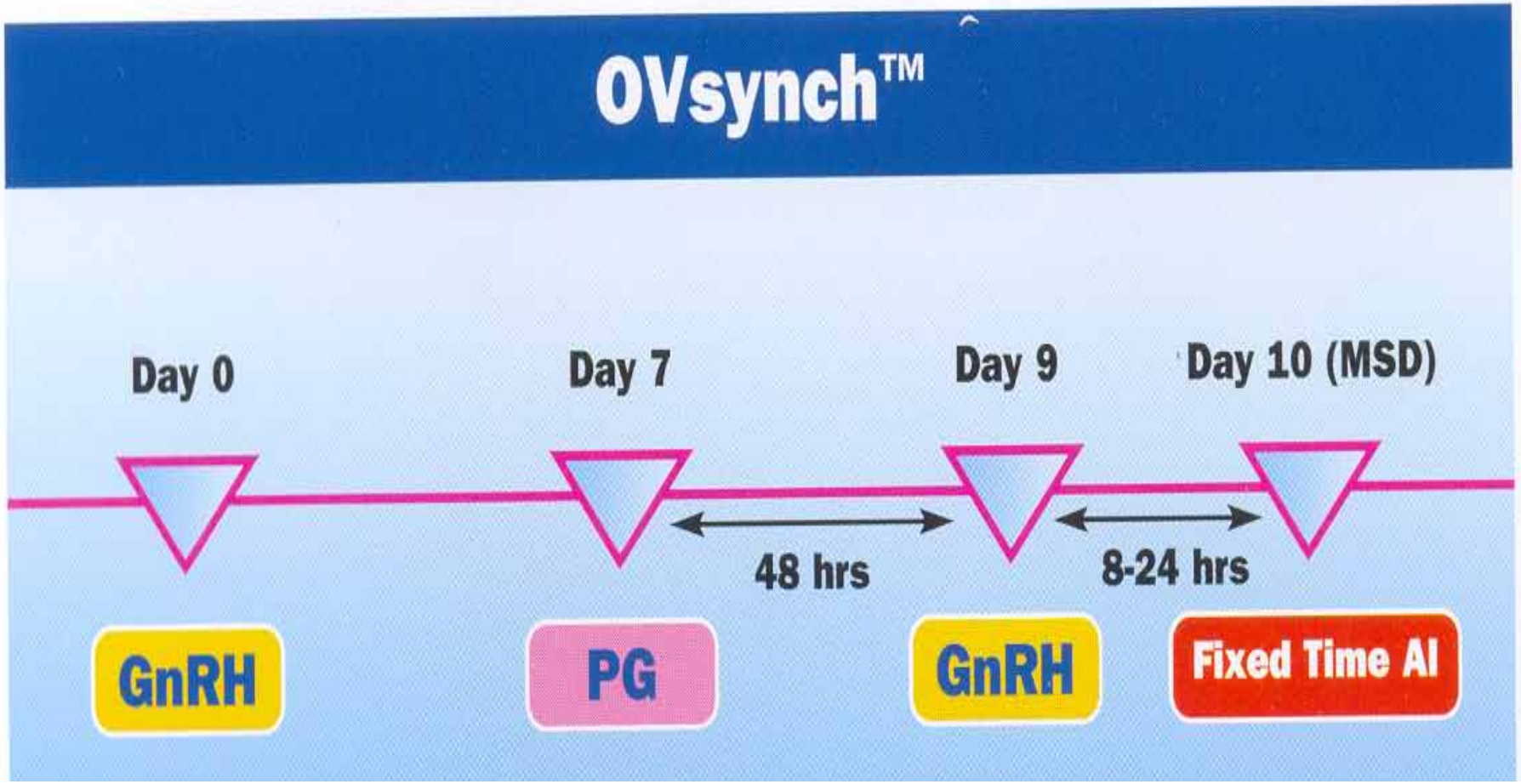


PG2

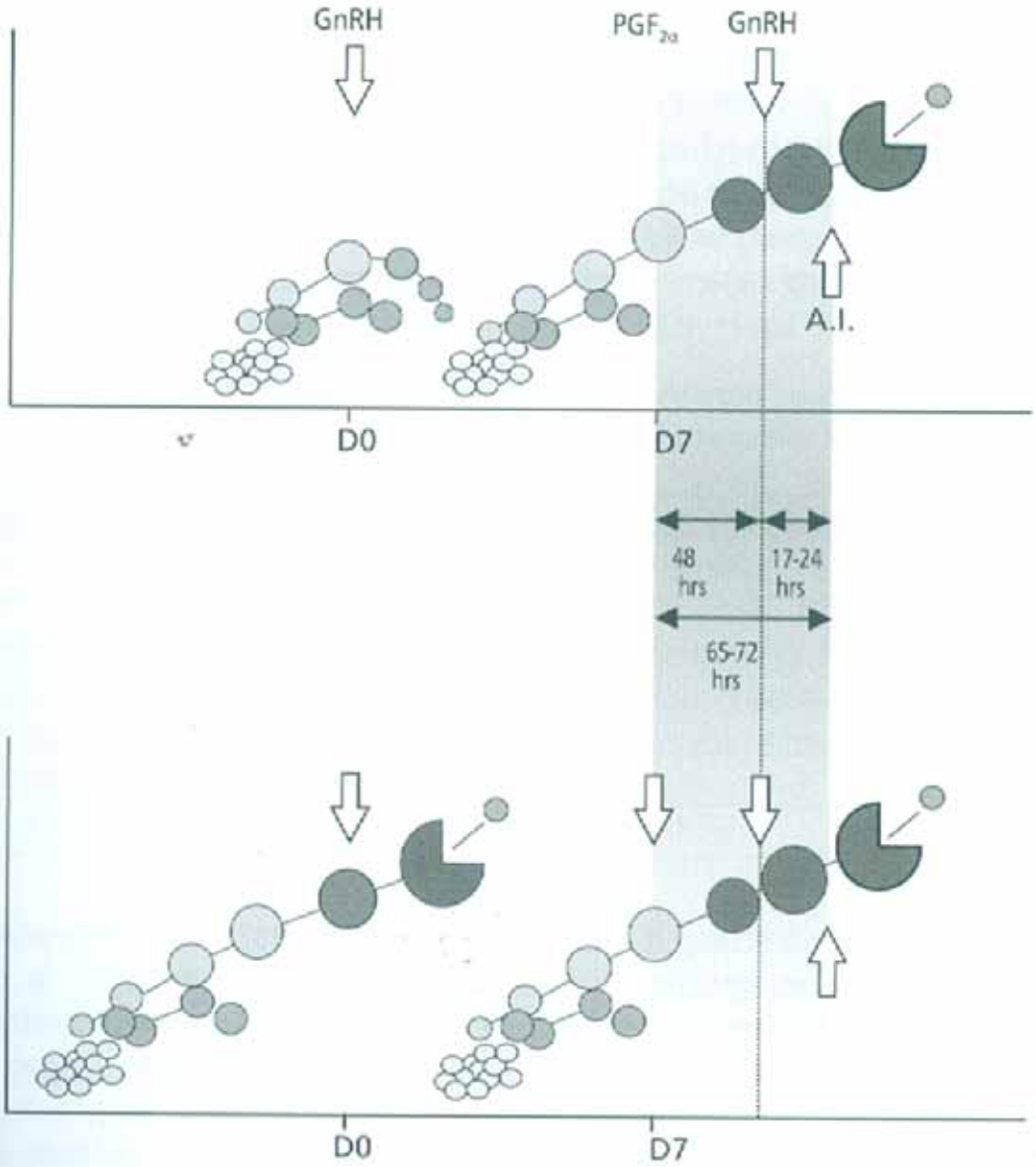


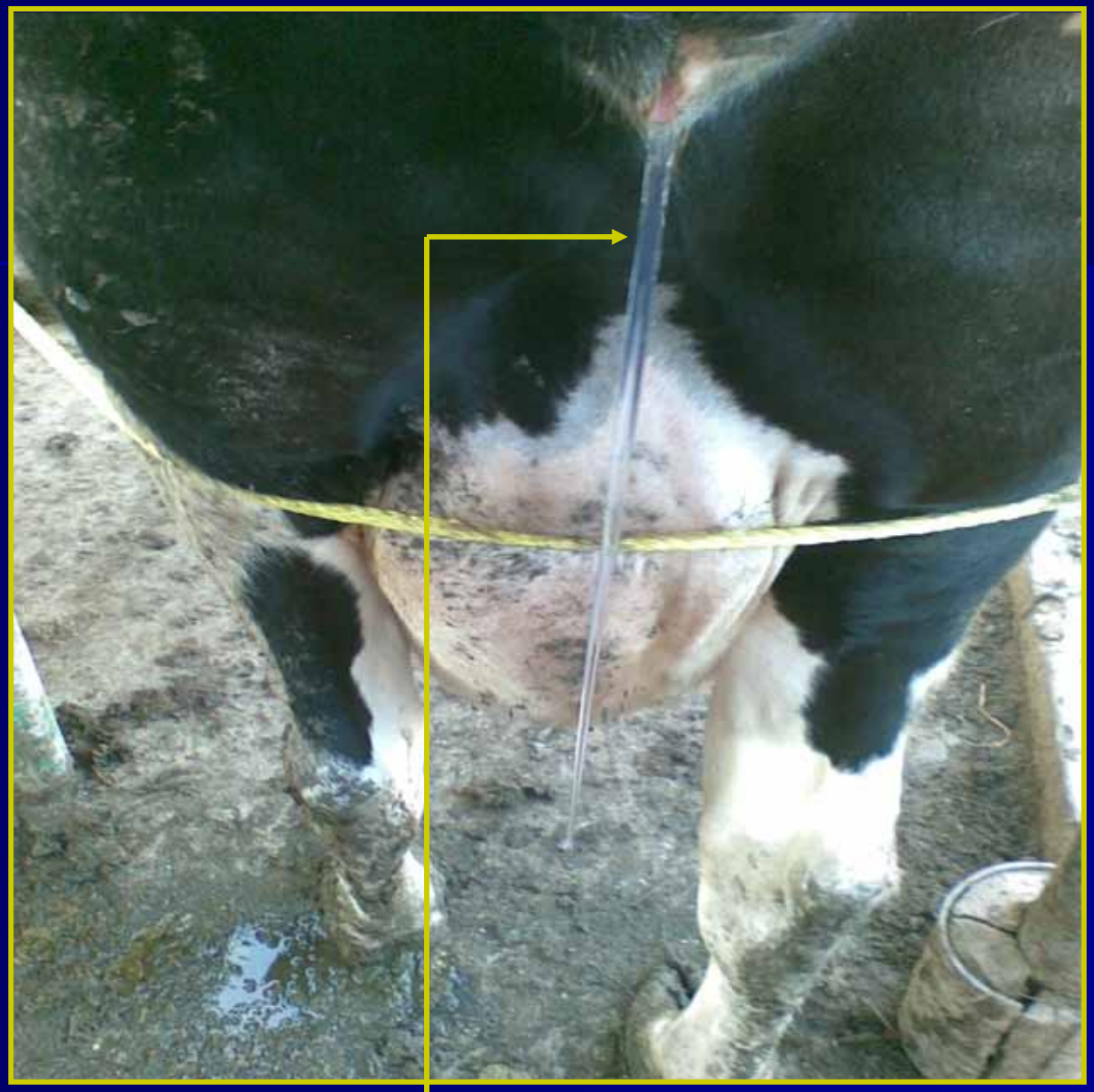

PG3
Oestrus observation and AI in cows detected in heat
AI at detected heat
11-14 days
Detection of oestrus 5-7 days
PGF
PGF
PG 4
Oestrus observation and AI in cows detected in heat
Fixed time AI
Fixed time AI
11-14 days
PGF
PGF
72 hrs
96 hrs
PG 5 Targeted breeding
Oestrus observation and AI in cows detected in heat
Oestrus observation and AI in cows detected in heat
Fixed time AI
11-14 days
11-14 days
72-80hrs
PGF
PGF
PGF

Hormone-based **Reproductive Programs**



Follicular dynamics in cows treated with the Ovsynch protocol





Clear ,Viscous & hanged estrus mucus

Clear ,Viscous & hanged estrus mucus


© Fekry Hussein

No external signs


Injuries during
standing heat

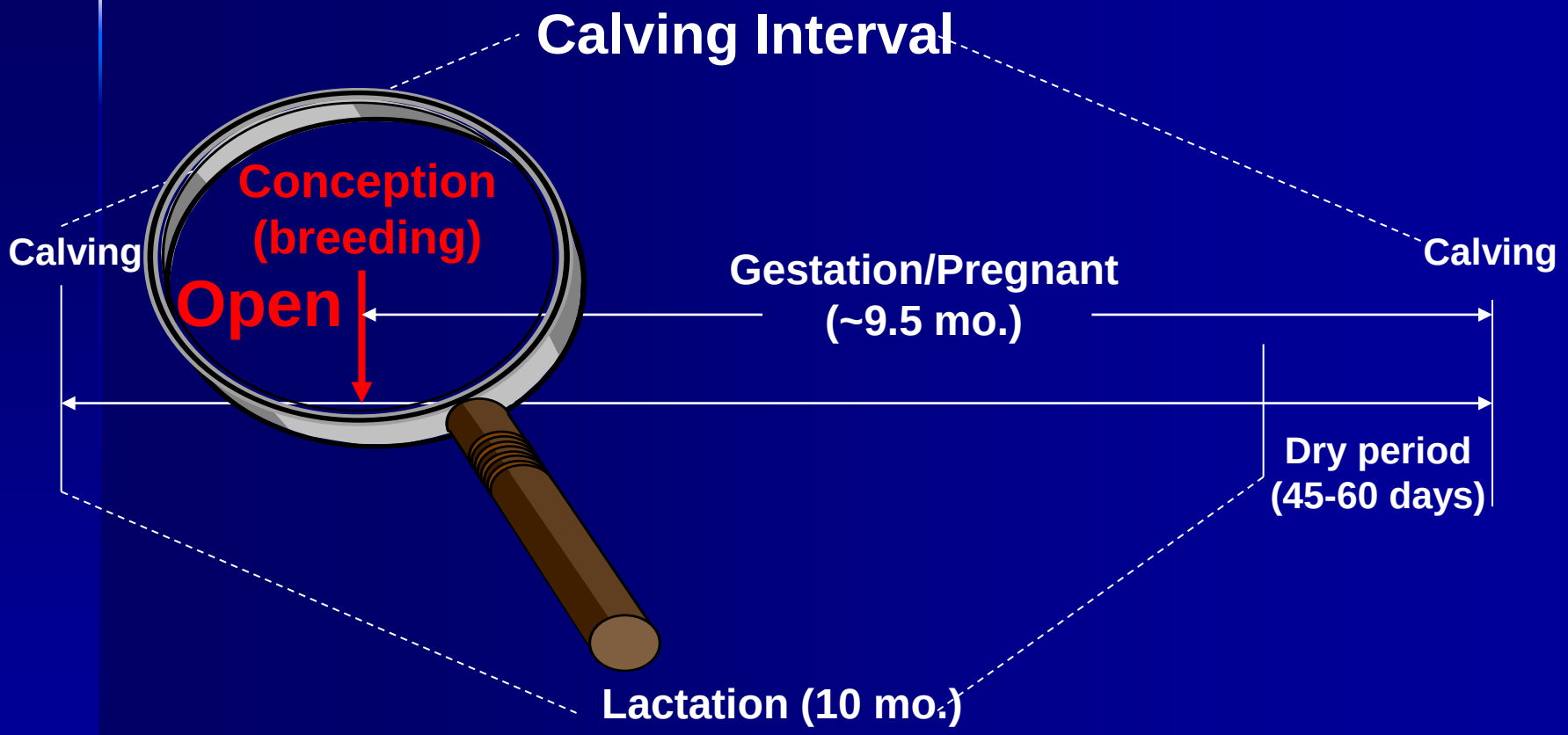

Injury during
standing heat

Post estrus bleeding (Metrorrahgia)

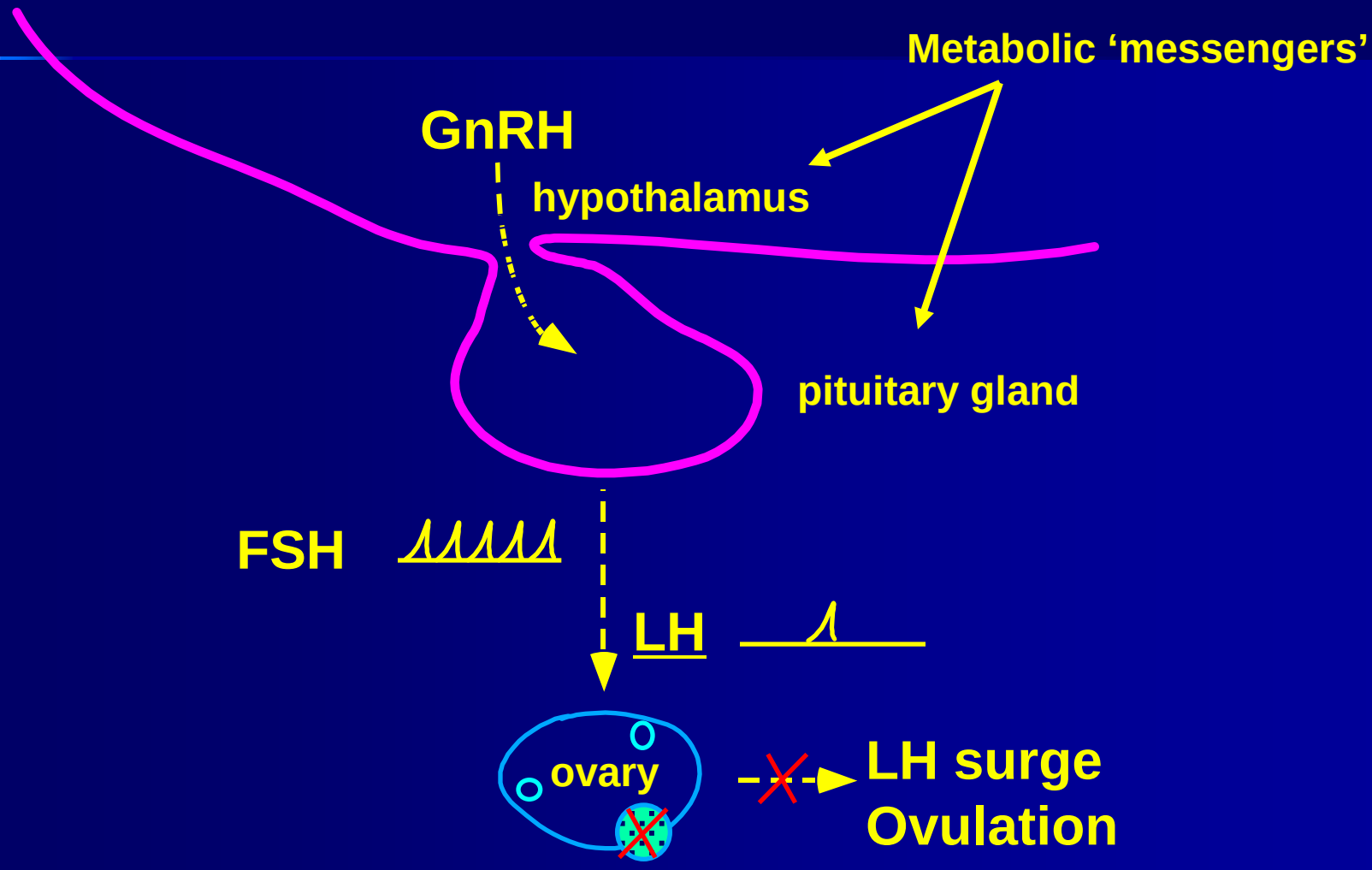
Extended calving interval

- Longer calving intervals result in longer lactation and longer dry period.
- The total loss increases with the length of the calving interval.
- Extended calving interval and is a direct result of increased calving to conception interval and is expressed in the number of so-called “days open”
- It has been a commonly recognised fact that an increased calving to conception interval results in losses which can be expressed in reduced overall milk production.

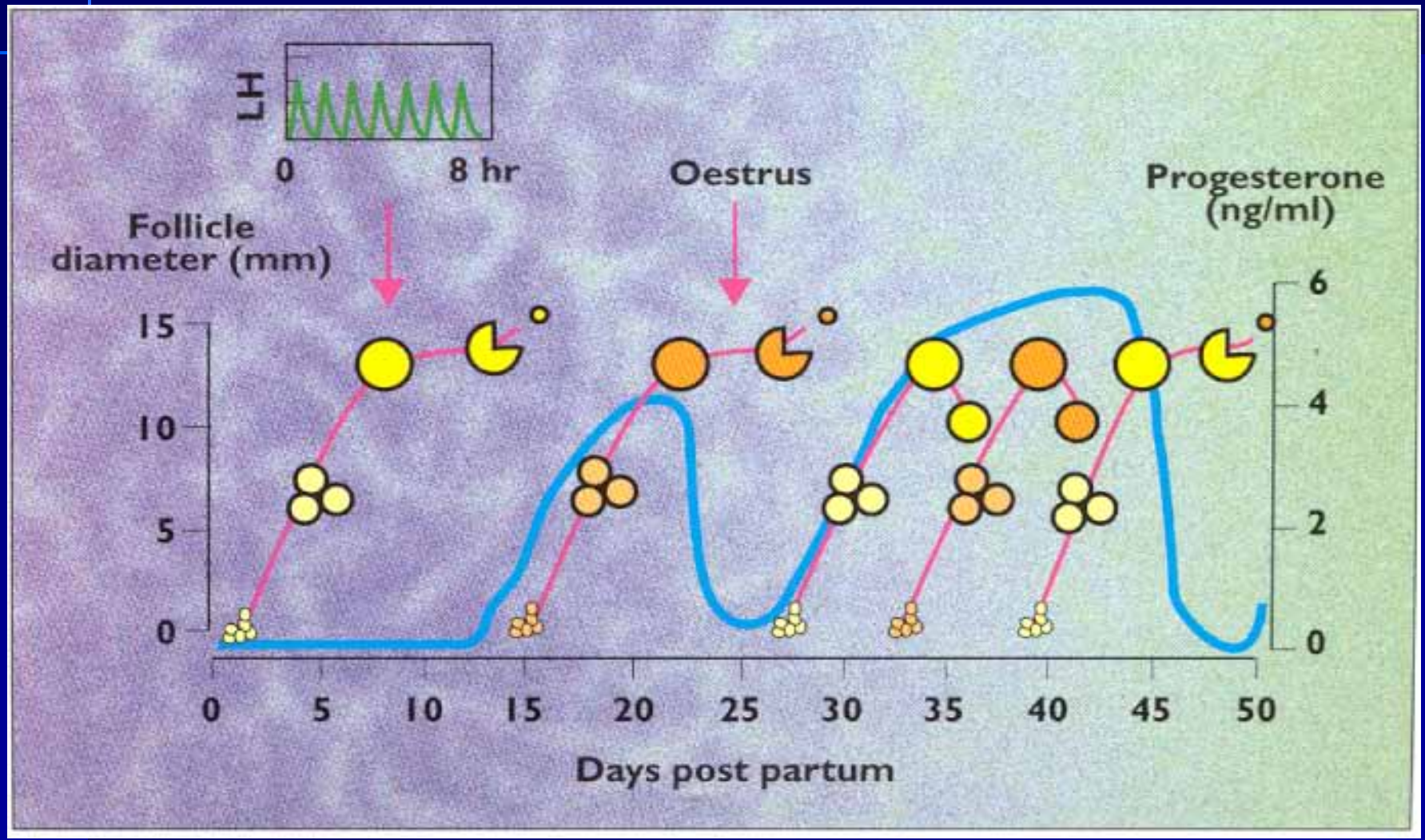
Calving interval components



Resumption of ovarian activity



Resumption of ovarian activity



Estimated losses associated with days open in dairy herds

Lactation	Loss Net per day in milk liters
Medium milk yield – 6.000 L/ lactation (305 d)	
1	10.88 L
5	15.03 L
Average	13.72 L
High milk yield of 10.000 L/ lactation (305 d)	
1	16.97 L
5	21.18 L
Average	19.87 L

Culling for reasons of reproductive failure

- Nowadays, the annual replacement rate can reach up to 34% in large commercial dairy operations in the US, and nearly as high in many larger dairies throughout the world, with fertility failure as one of the principal reasons.

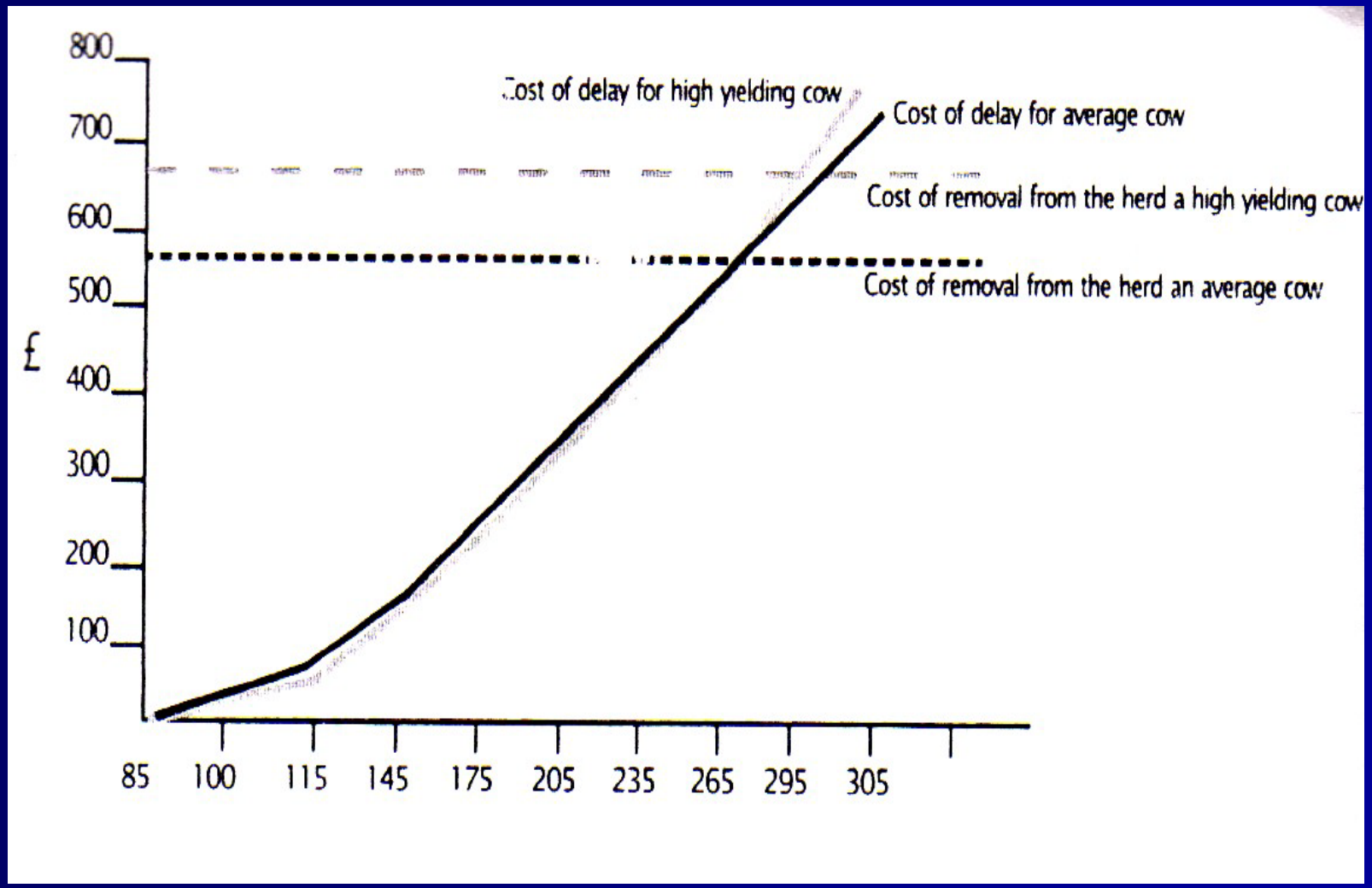
- The losses caused by premature culling due to infertility depend on the age and the production level of the cow culled.

- These losses represent the missed future income from the cow.

- There are maximal for high-yielding cow in her second lactation, and thereafter decrease with age and lower production level.

- When a valuable young cow is culled, it is not only her future milk production which is lost, but also her genetic potential as the source of replacement heifers.

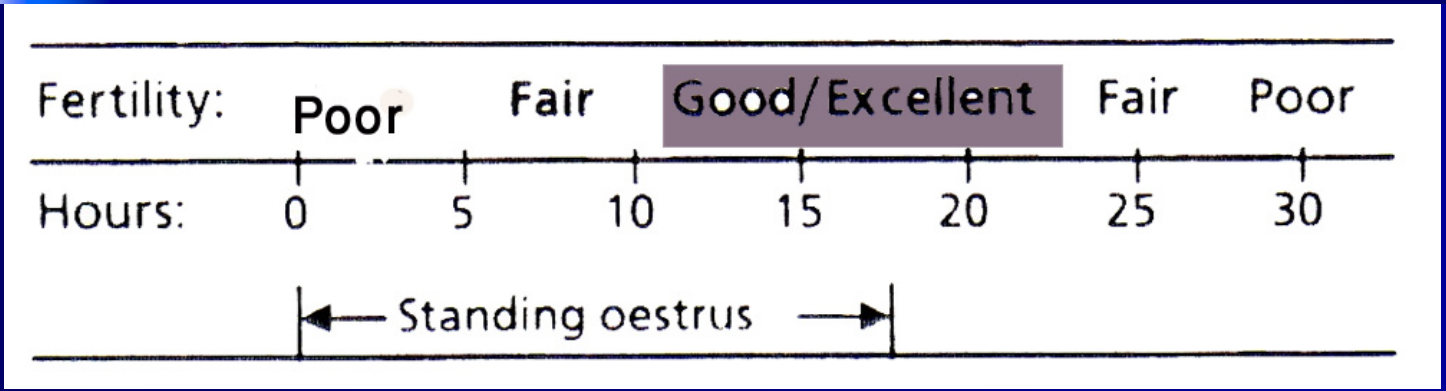
Estimated cost of culling in the herd



- Moreover, with a high annual replacement rate, the age of the herd shifts towards an increasing proportion of first calving heifers.

- Above a certain threshold, this is unfavorable with respect both to milk production and also to reproductive efficiency, as first calves are the group with the greatest frequency of post partum reproductive disorders.

Optimum time of insemination in relation to oestrus



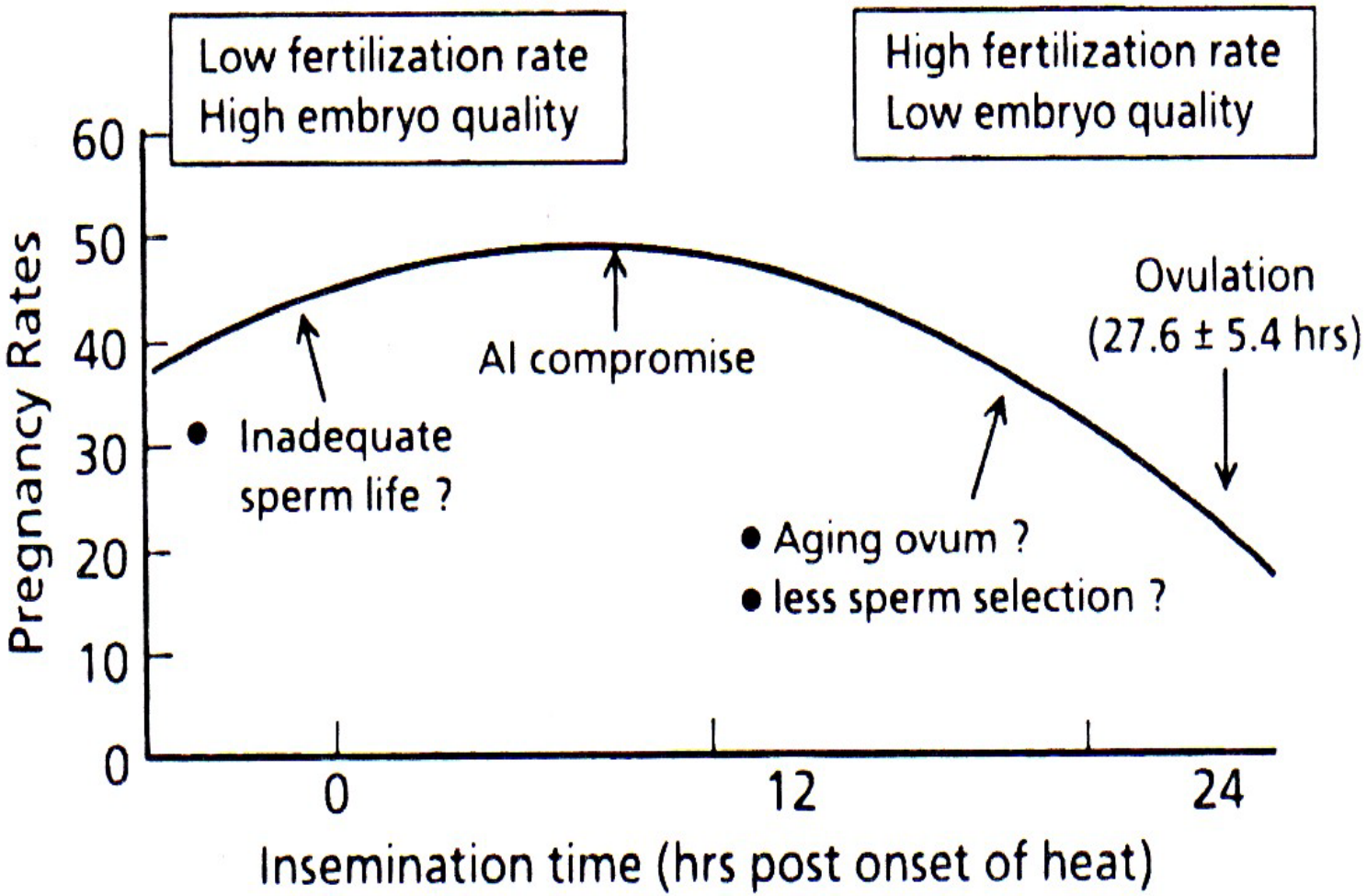
For practical purposes it is best to use the AM/PM rule: all cows seen in oestrus during the morning are inseminated during the afternoon.

Cows still in heat the next morning are re-inseminated. Cows observed in oestrus during the afternoon or evening, are inseminated the following morning.

Early insemination gives good prospects for an embryo of high quality, but at a lower fertilization rate (decreased sperm survival due to "waiting" for the oocyte).

Late insemination makes a high fertilization rate possible (a lot of fresh sperm) but due to ageing of the oocyte which ovulated much earlier, there is a risk of low embryo quality.

Calculated pregnancy in relation to the insemination time (adapted from Saacke 2008)



Negative energy balance

a. Decrease in LH release.

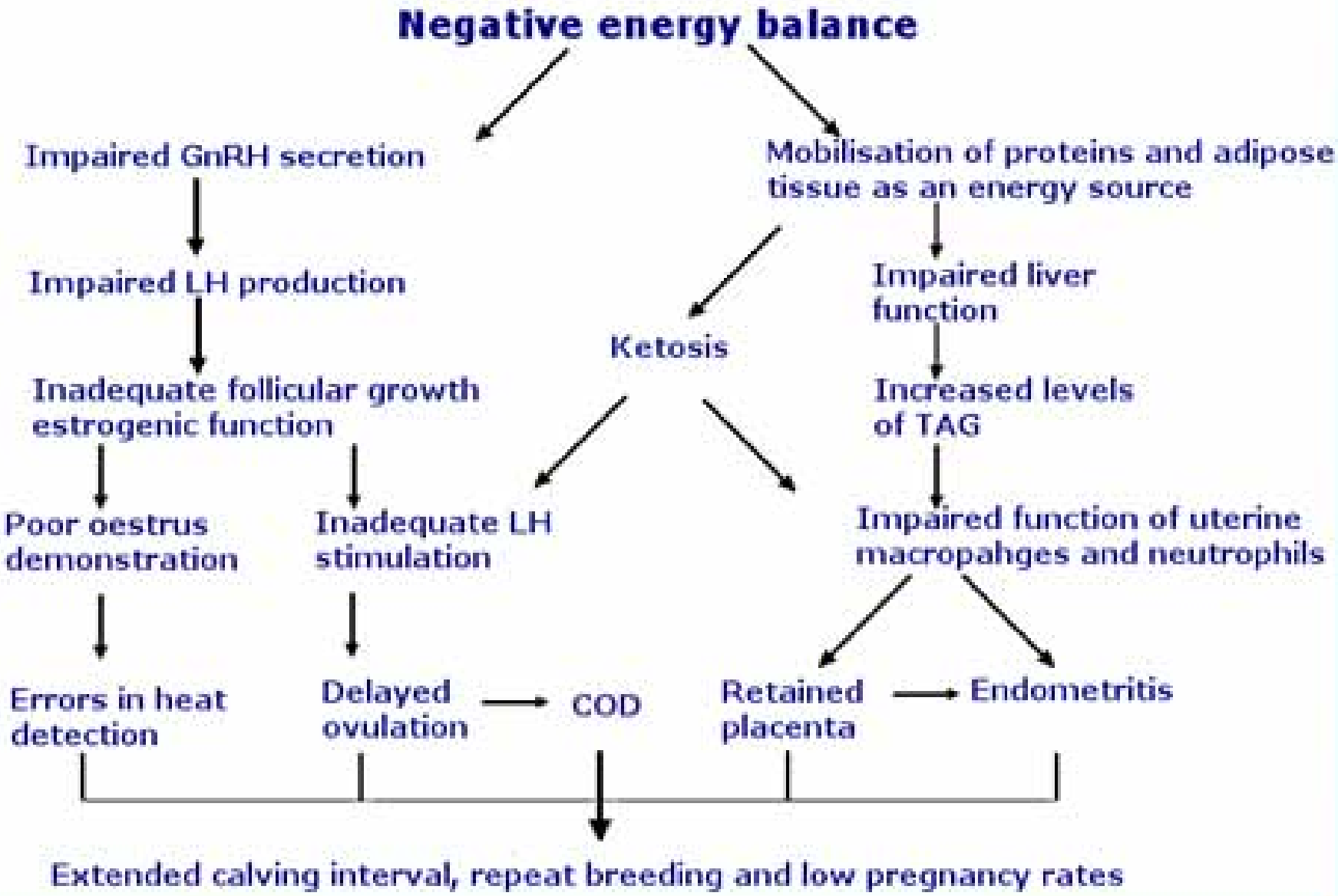
b. Decrease reactivity of ovary to LH stimulus

c. Decrease in progesterone production

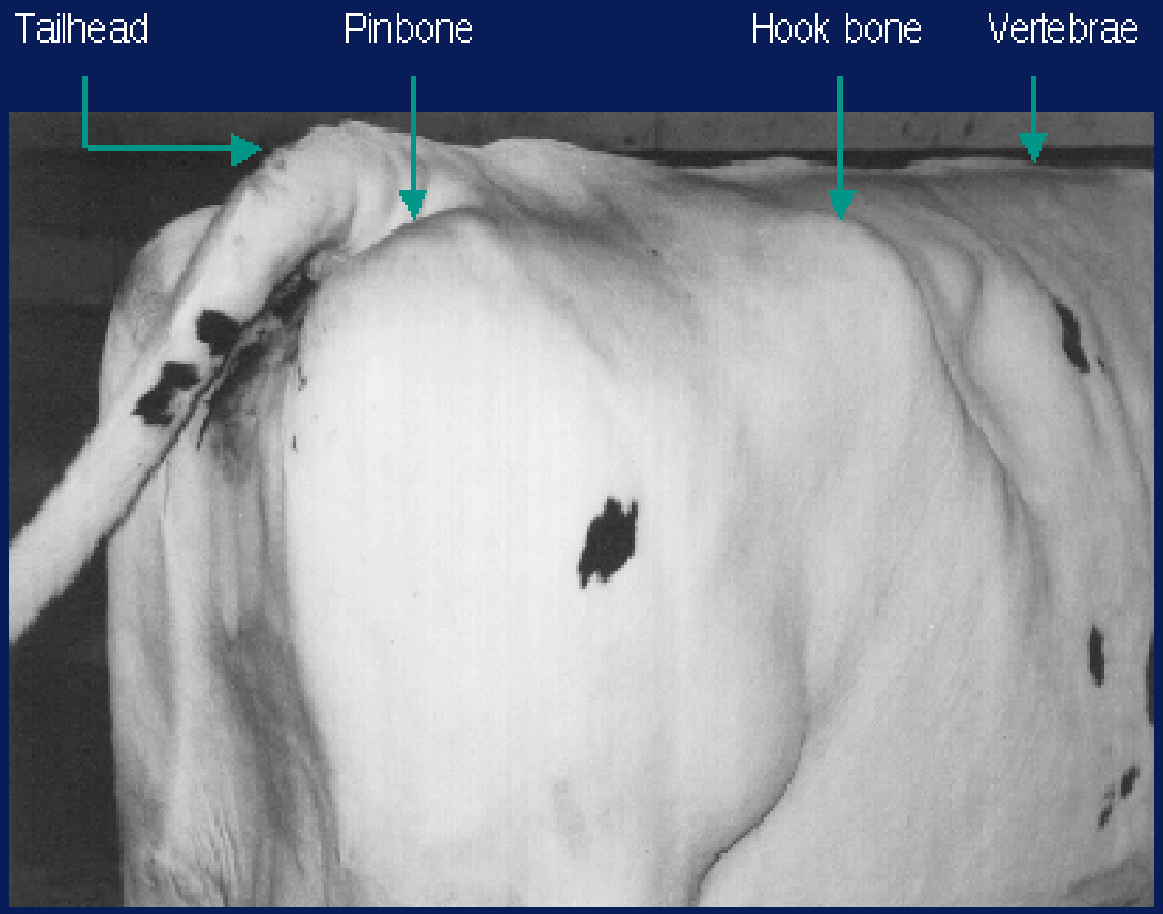
a. Delay in resumption of cyclic ovarian activity.

b. Impaired follicular growth and development (COD).

c. Insufficient CL function (EMM).


Negative energy balance
Impaired GnRH secretion
Mobilisation of proteins and adipose tissue as an energy source
Impaired LH production
Impaired liver function
Ketosis
Inadequate follicular growth estrogenic function
Increased levels of TAG
Poor oestrus demonstration
Inadequate LH stimulation
Impaired function of uterine macropahges and neutrophils
Errors in heat detection
Delayed ovulation
COD
Retained placenta
Endometritis
Extended calving interval, repeat breeding and low pregnancy rates

Body parts used to assign body condition scores



Poor condition score

Micro-organisms in the uterus produce

Endotoxins

Trigger

$PGF_2\alpha$ Release

Which in turn

Stimulates the secretion of cortisol

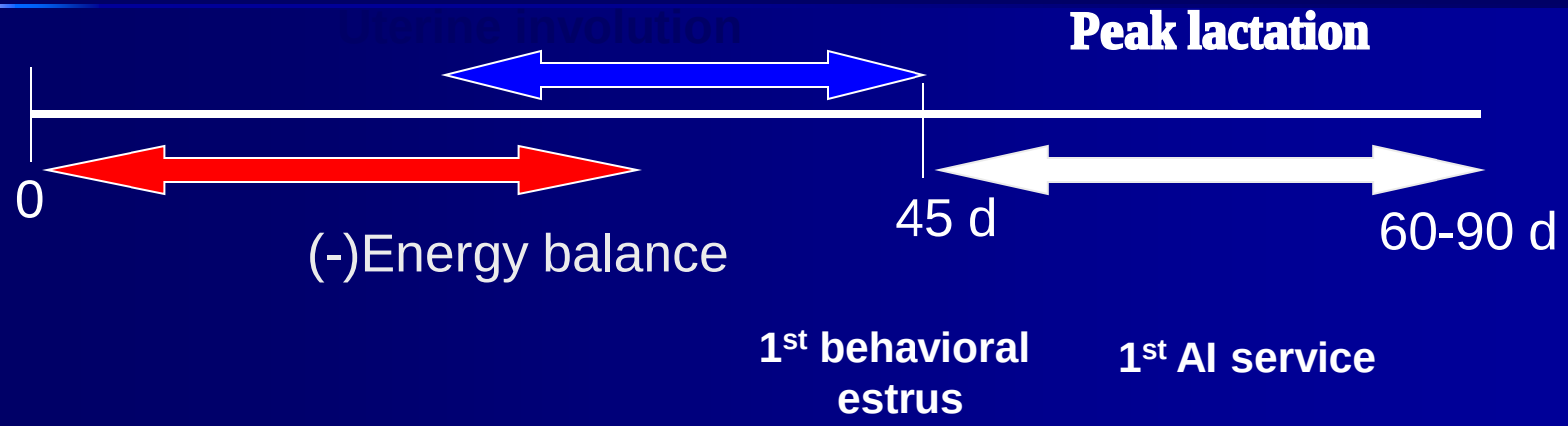
The elevated cortisol levels suppress the pre-ovulatory release of LH and

Lead to

Development of Cysts

Postpartum group

Breeding group



The reproductive problems of the individual cow can be divided into the following groups:

- Retained placenta
- Uterine infections
- Anoestrus
- Cystic Ovarian Disease (COD)
- Embryonic mortality
- Repeat breeders
- Abortion

Why metritis matters to dairy farm fertility and productivity

Clinical metritis is an ***inflammation of the uterus,*** *usually caused by* ***microbial infection.*** *It occurs within 21 days after parturition, though* ***most frequently in the first 10 days.***

The incidence and impact of metritis are often underestimated

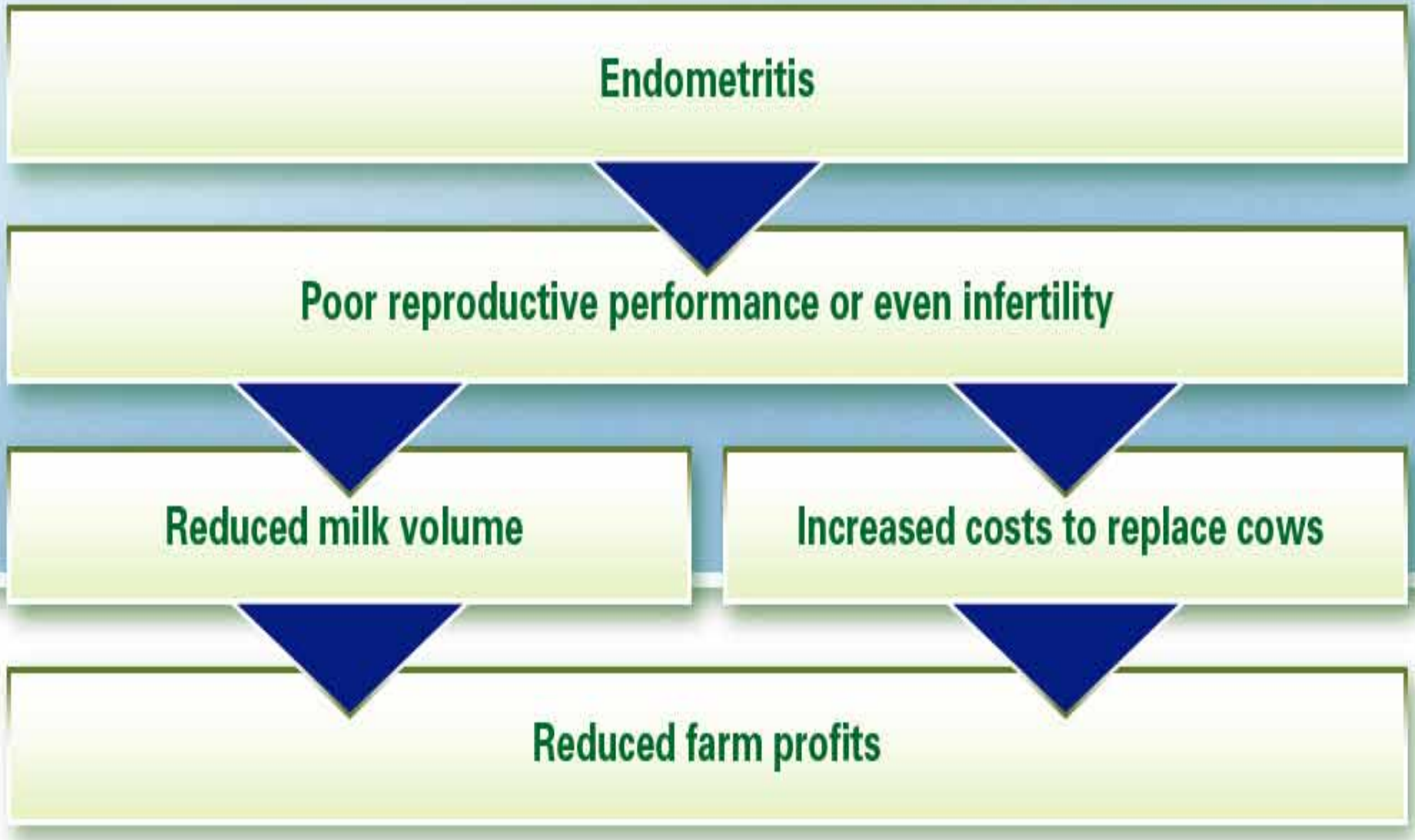
Incidence[1]:

- Much higher in modern, high-yield dairy cows (> 9,000 kg milk/year) than generally accepted average of 20-35 %
- May reach up to 50 % depending on how diagnosis is made
- Incidence of uterine infections:
  - 37 % in dairy cows (5000 dairy cows)[2]
  - 29 % in beef cows (6000 beef cows)[2]

Impact[1]:

- Increased calving interval, which is an important risk factor for postpartum ovarian disorders
- Reduced pregnancy rates, which leads to higher infertility-related culling rates
- Reduced milk yield, caused by reduction in dry matter intake
- Increased risk of metabolic disorders such as abomasal displacement and ketosis

IF LEFT UNTREATED, METRITIS CAN LEAD TO:



1 G. Opsomer, 21 Recommendations against metritis, 2008, pp 17-28
2 Personal communication from Pr Ch. Hanzen, University of Liège

Why early metritis detection makes the difference[3]

Systemic examination of all postpartum cows is essential

- Cows are at **highest risk** of developing metritis within **first 10-14 days** after calving
- **Abnormal vaginal** discharge between days 2 and 10 could be sign of metritis
- **No increase in milk yield** after calving or sudden drop could indicate infection

Checking rectal temperatures is key – it identifies 4 times as many affected cows as farmer observation alone.

METRITIS CAN BE PRESENT IN SEVERAL GRADES, RANGING FROM MILD TO SEVERE

1. Clinical metritis grade 1

- Abnormally enlarged uterus
- Purulent uterine discharge in the vagina

2. Clinical metritis grade 2 (puerperal metritis)

- Abnormally enlarged uterus
- Fetid watery red-brown uterine discharge

- Decreased milk yield
- Dullness
- Fever > 39.5 °C

3. Clinical metritis grade 3 (toxaemic metritis)

- Additional signs of toxaemia such as inappetance, cold extremities, depression and/or collapse

Related to metritis[3]: clinical endometritis

Presence of purulent uterine discharge detectable in the vagina 21 days or more postpartum. The uterus is not markedly enlarged. Up to 40 % of animals have clinical metritis in the first 2 weeks after calving, and disease persists in up to 20 % of animals as clinical endometritis.

Don't let metritis compromise fertility

PROTECT FARM PRODUCTIVITY WITH FERTILITY MANAGEMENT PROGRAMME

- Fast action against common cattle pathogens (Gram+, Gram-, including anaerobes)
- Helps maintain a healthy reproductive cycle by fighting common infections such as metritis and foot rot
- Ensures maximum milk production
- Preserves farm productivity and profitability
- Provides peace of mind


Thank you
© Fekry Hussein