

# PHYSIOLOGICAL PRINCIPLES UNDERLYING SYNCHRONIZATION OF ESTRUS

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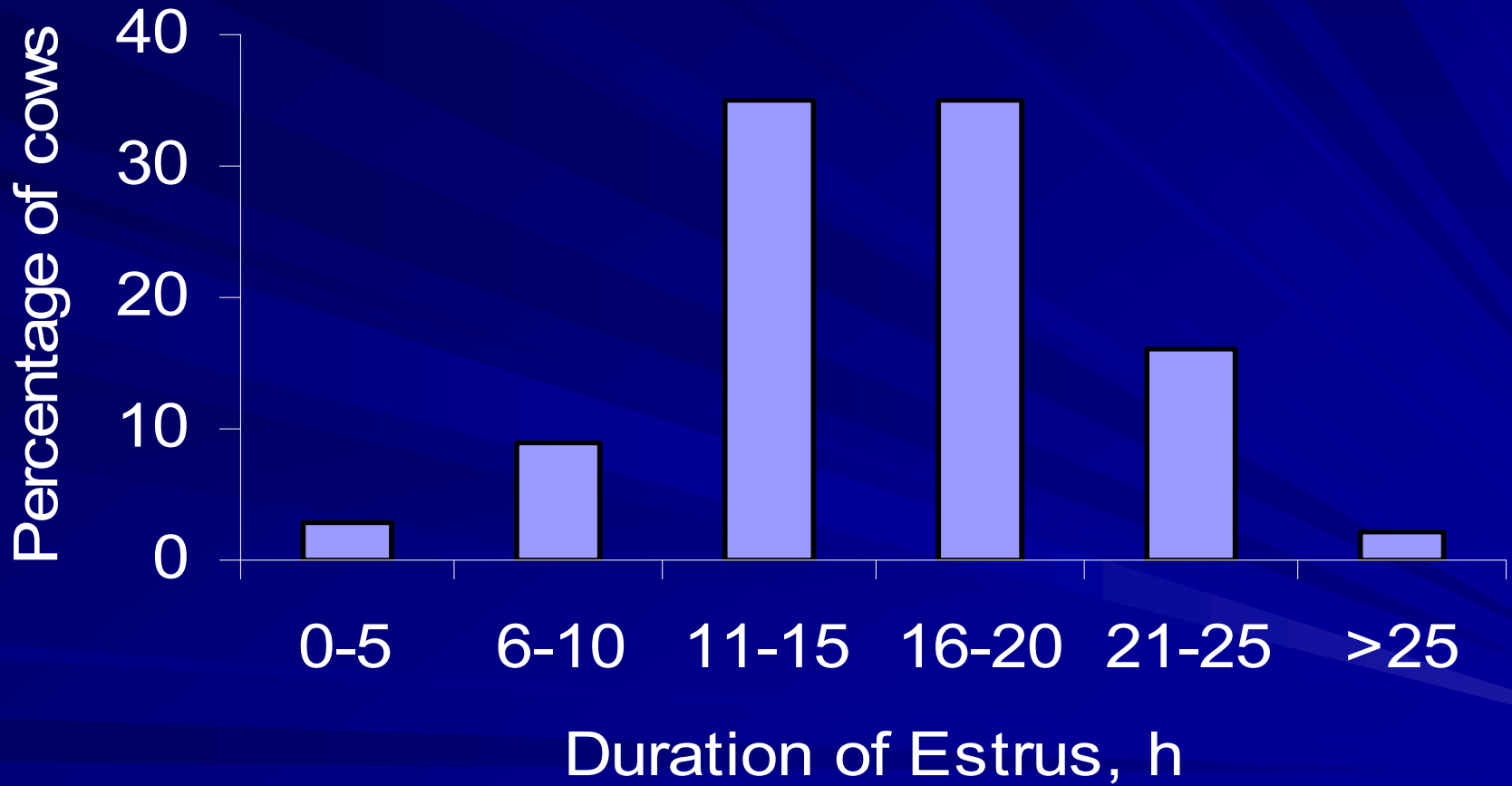
# Overview

- Physiology of the bovine estrous cycle
- Hormones utilized for estrus synchronization
- Estrus synchronization products
- Hormonal management of the luteal phase
- Hormonal management of follicular waves
- Management considerations

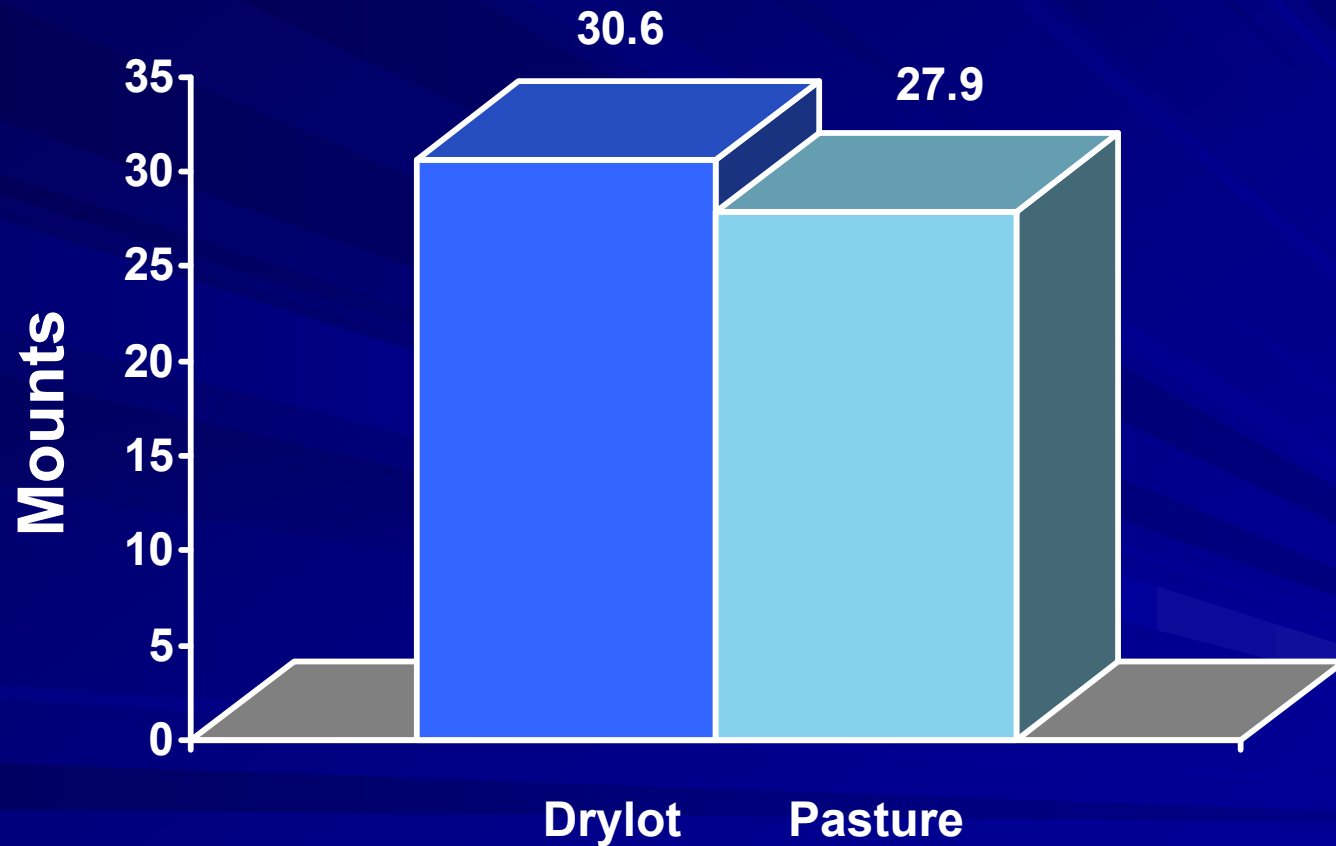
# Characteristics of the Estrous Cycle

- Length of the estrous cycle
  - Average 21 days (range 17 to 24 days)
  - Two follicular waves – 17 to 20 days
  - Three follicular waves – 21 to 24 days
- Estrus (standing heat)
  - 12 to 18 hours (range 8 to 30 hours)
- Ovulation
  - Approximately 30 hours after the beginning of standing estrus

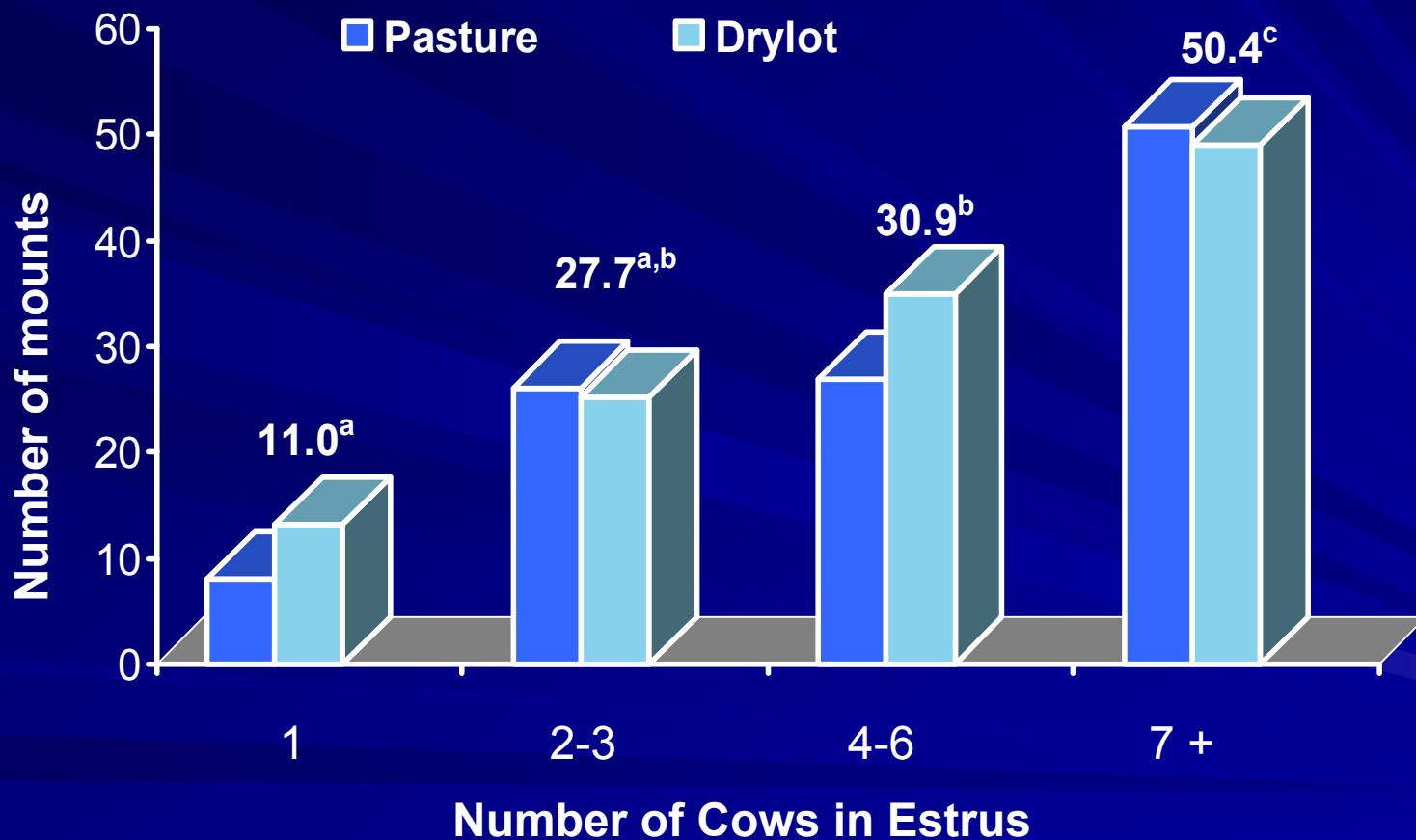
# Duration of Estrus



# Influence of confinement area on the number of mounts per estrus ( $P > 0.5$ )



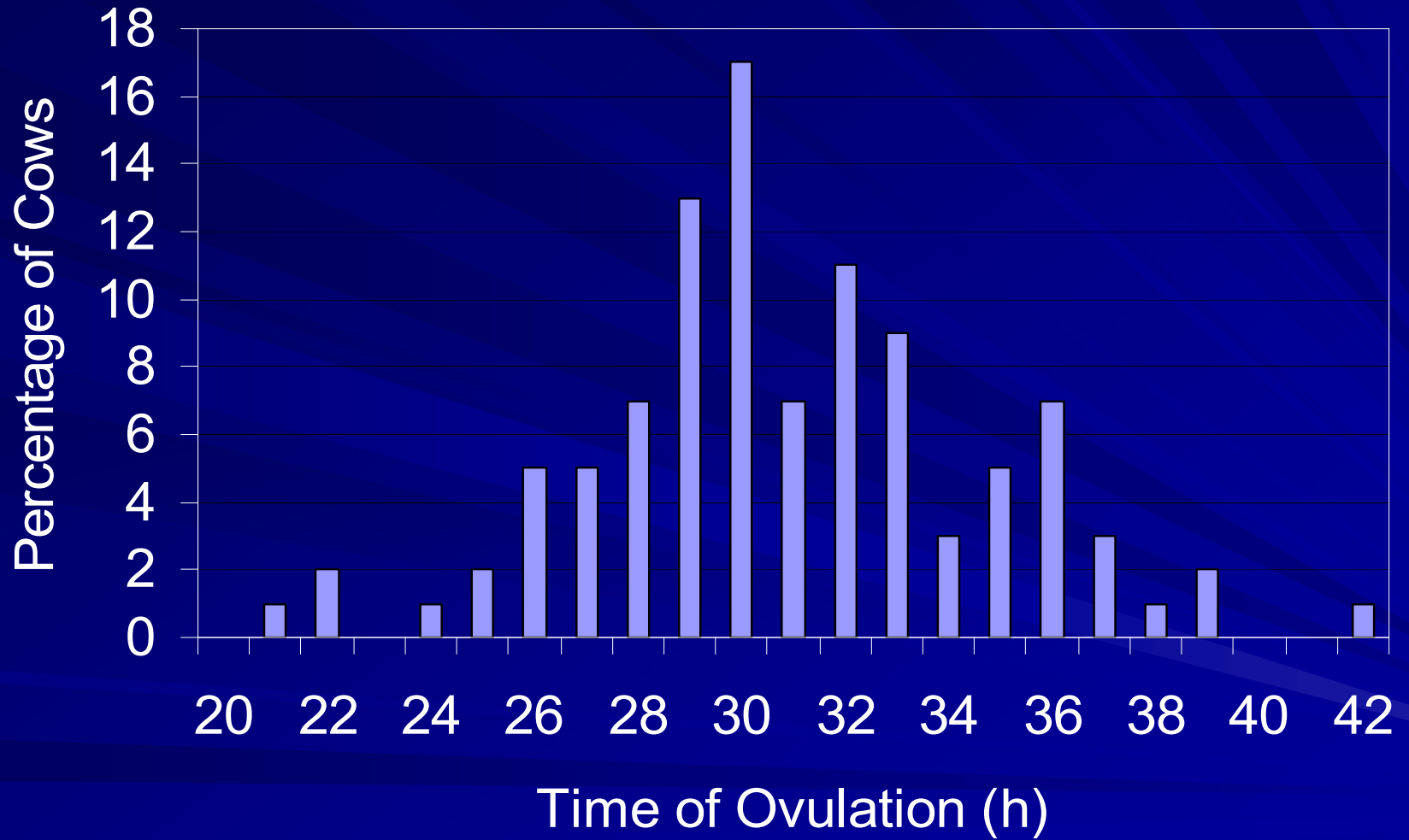
# Influence of the number of cows in estrus on number of times cows are mounted in drylot or pasture



<sup>a,b</sup> superscripts differ  $P < 0.07$

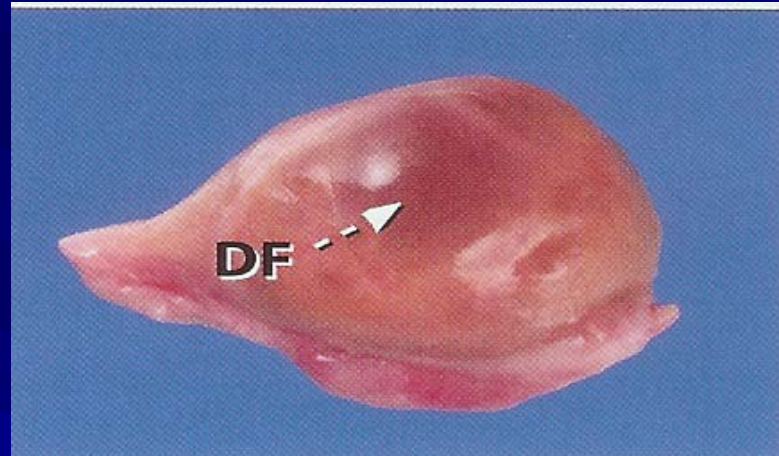
<sup>b,c</sup> superscripts differ  $P < 0.002$

## Variation in Ovulation Time



# Ovarian Structures

- Graffian follicle

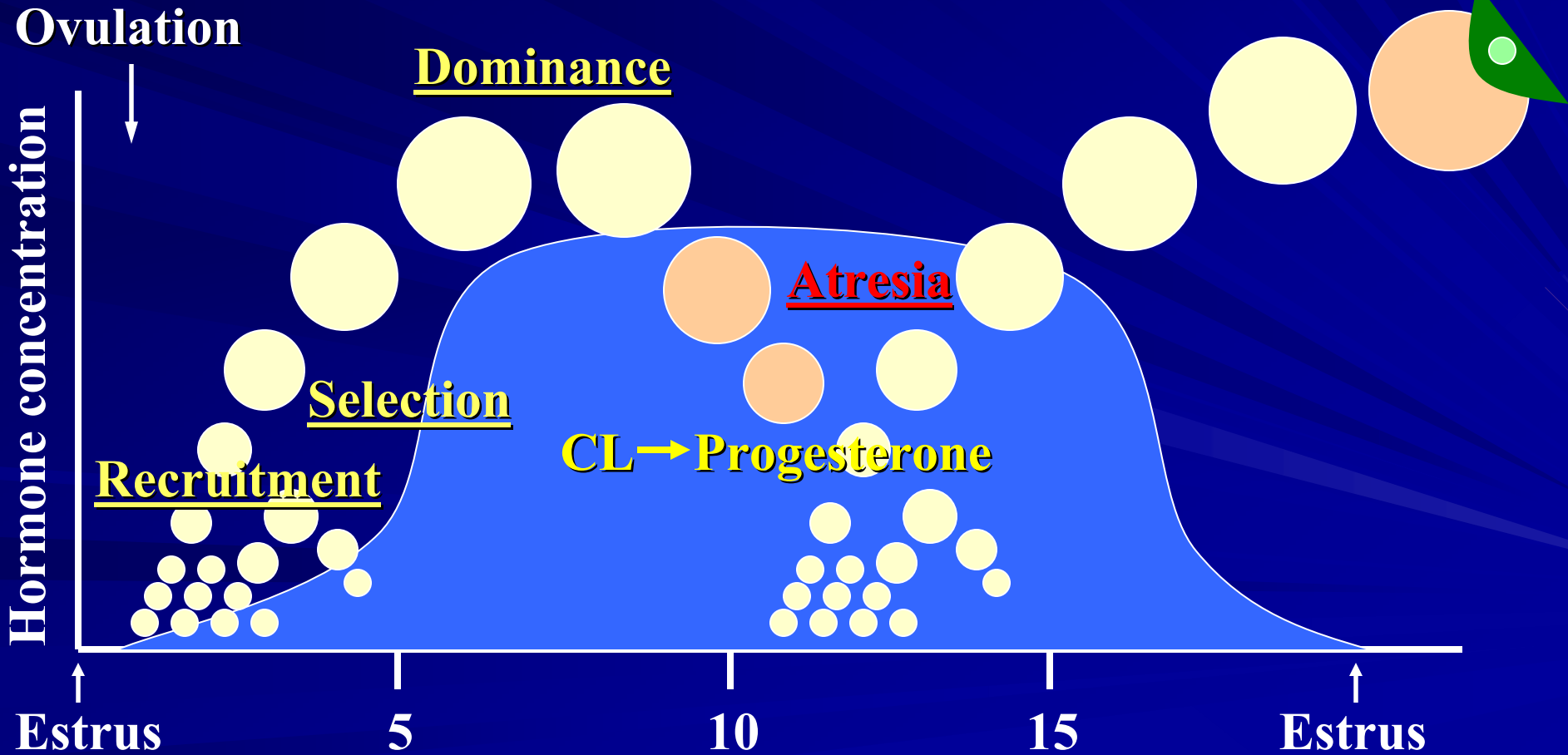


- Corpus luteum



# The Estrous Cycle

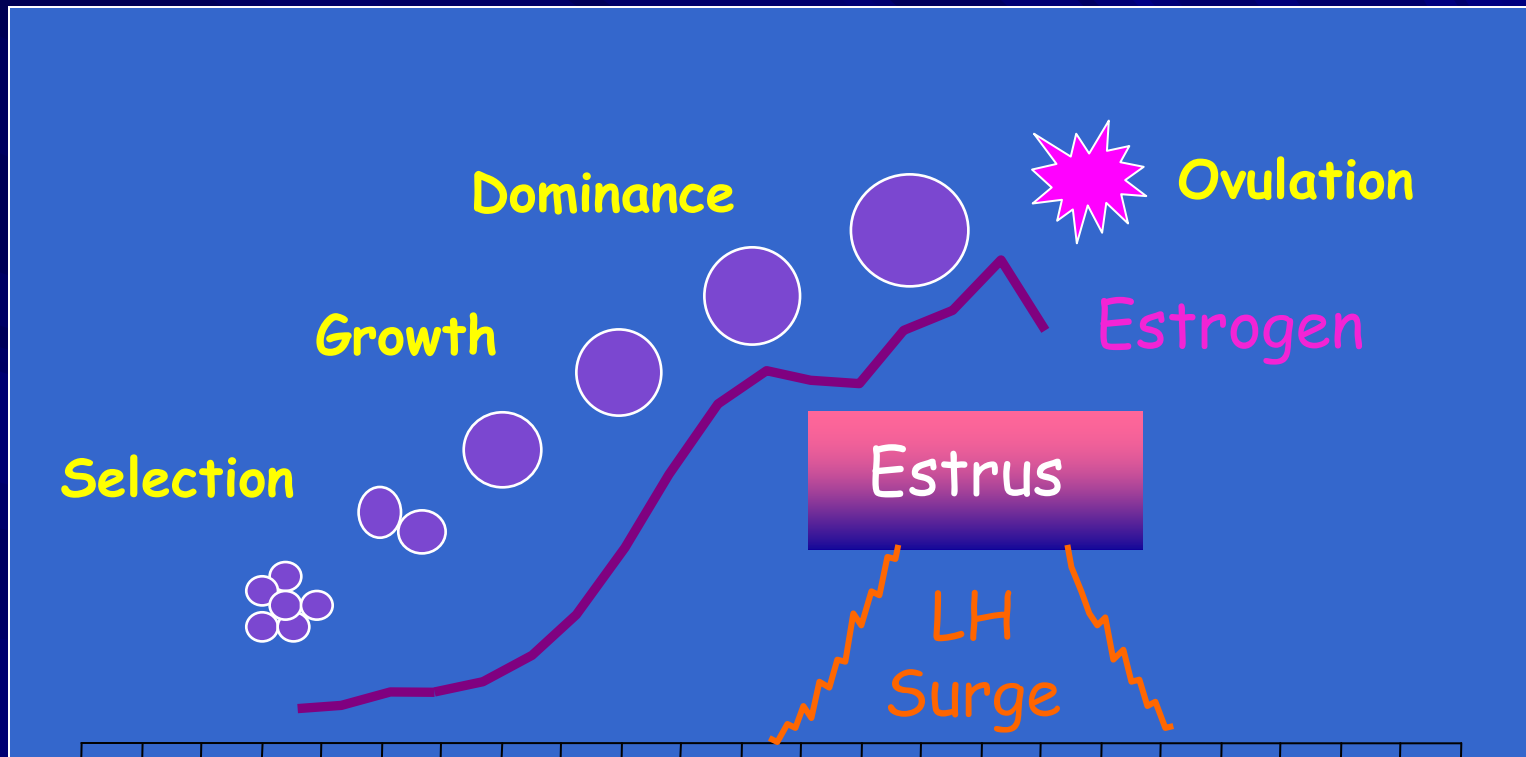
Ovulation



# Stages of the Estrous Cycle

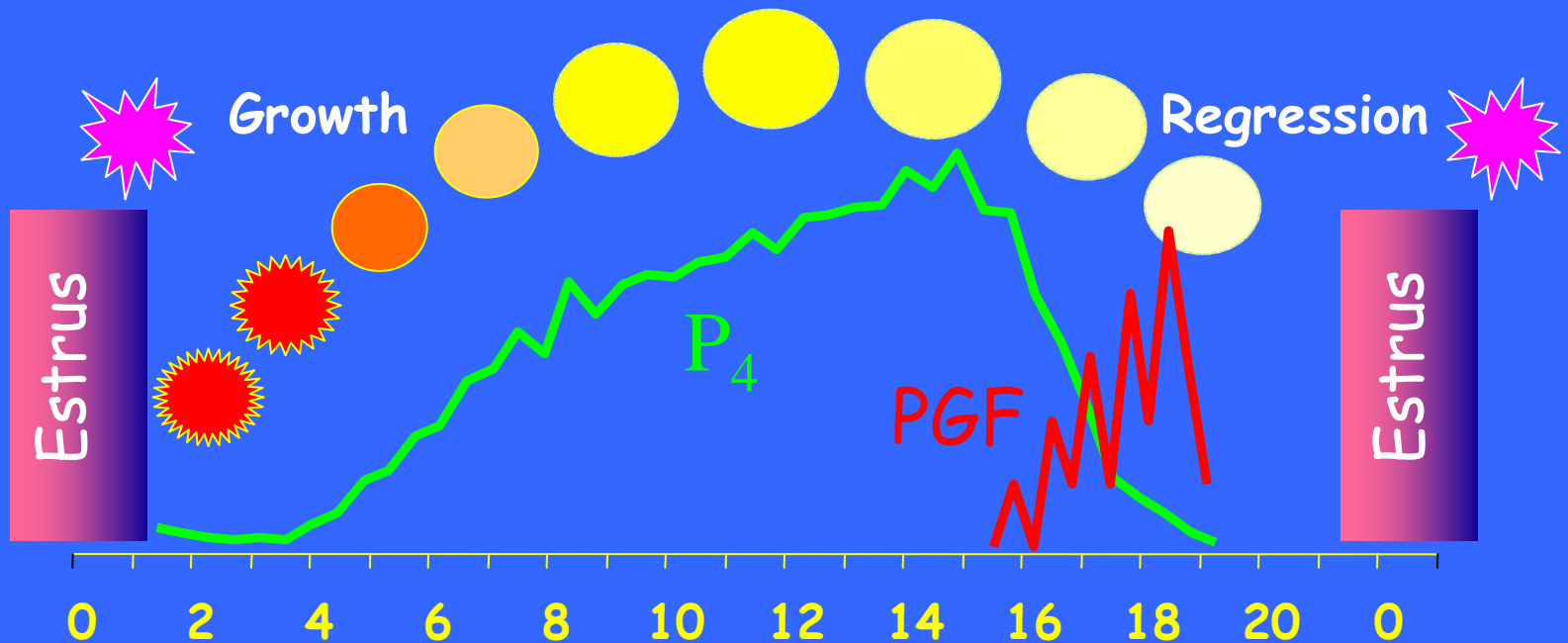
- Follicular Phase
- Estrus
- Luteal Phase

# Follicular and Estrus Phases



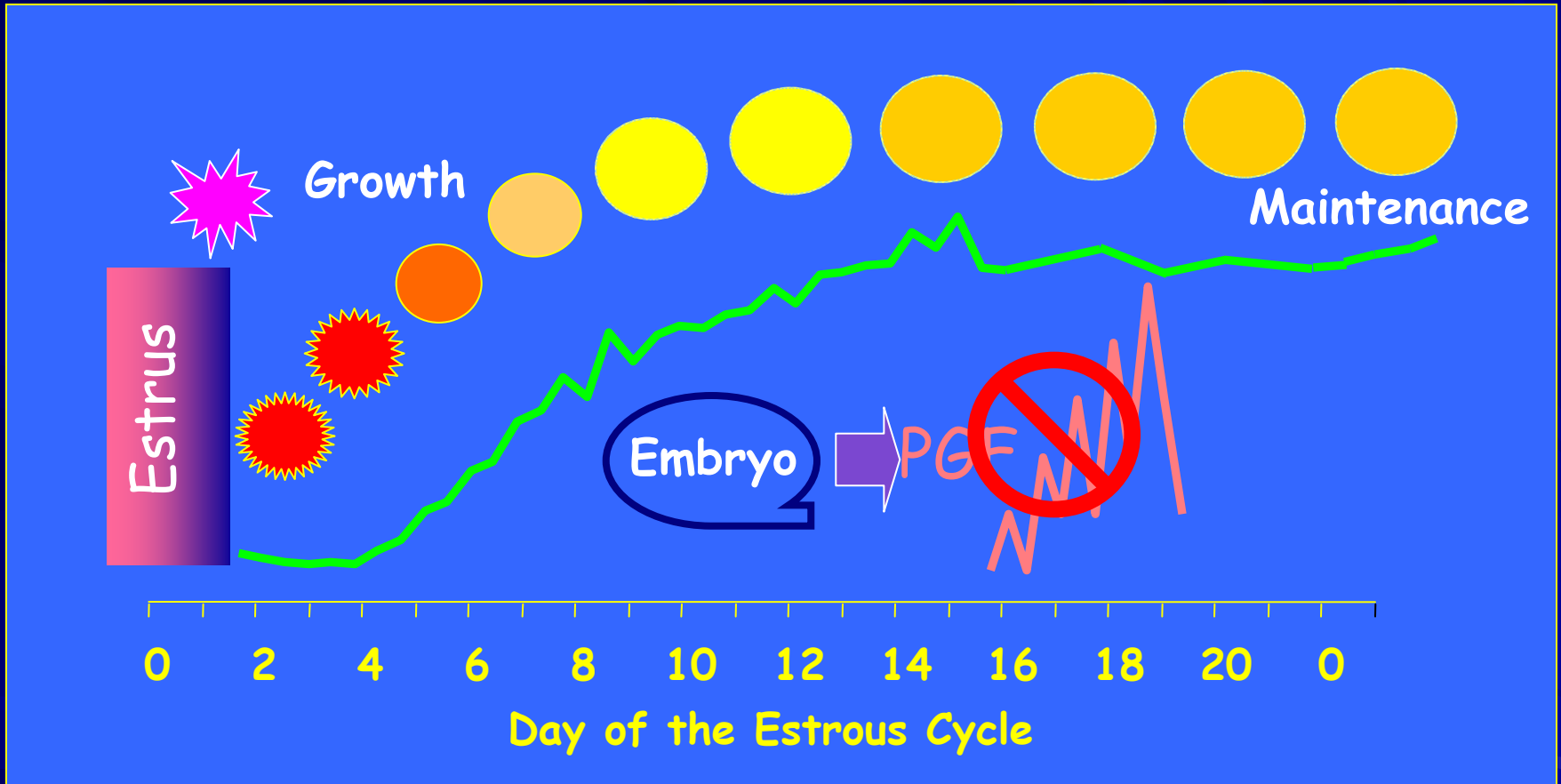
- Maturation of the preovulatory follicle
- Estrous behavior
- Ovulation (induced by the LH surge)

# Luteal Phase



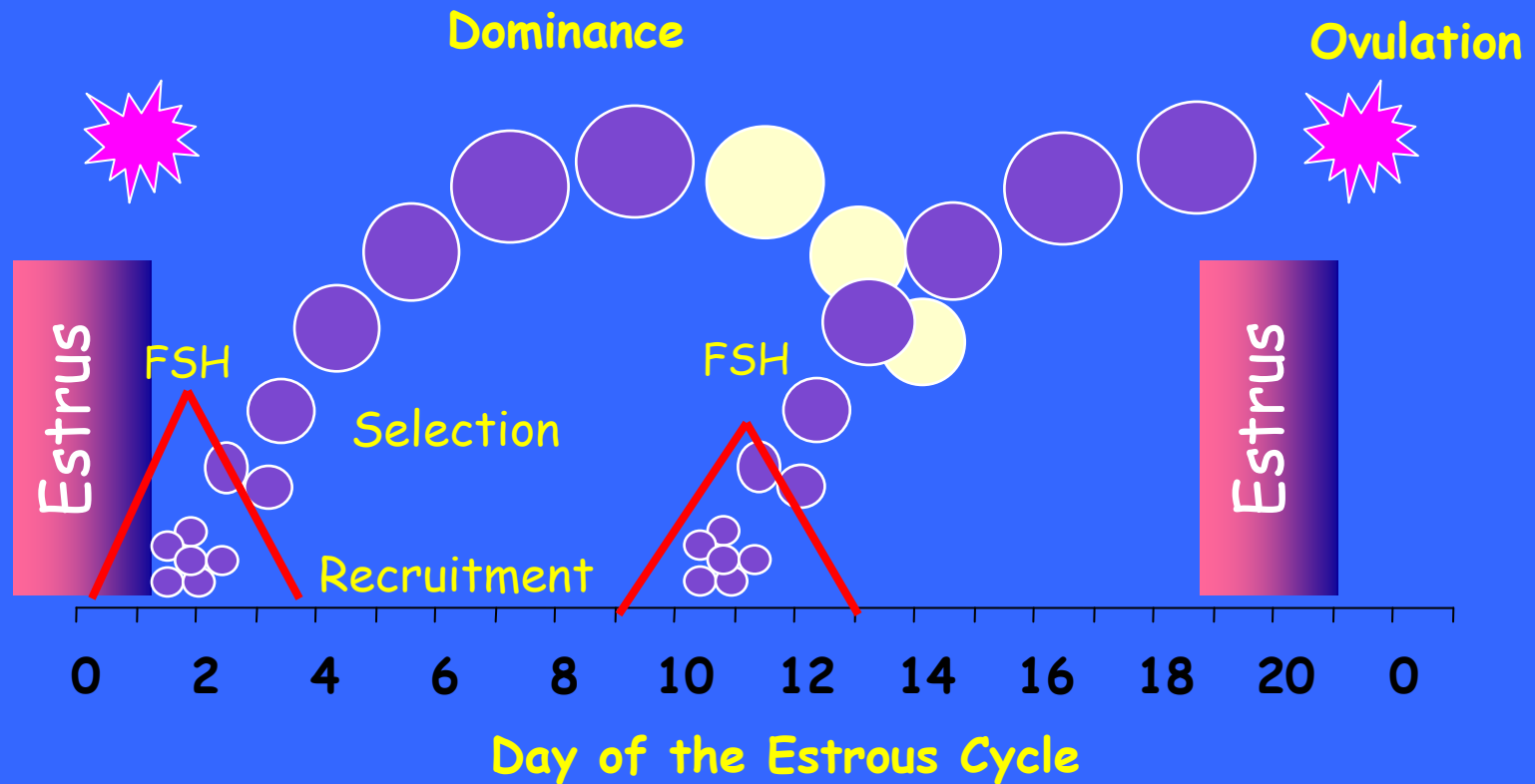
- P<sub>4</sub> = Progesterone – CIDR and MGA
- PGF = Prostaglandin F – Lutalyse, ProstaMate, In Synch, Estrumate, estroPLAN

# Corpus Luteum and Pregnancy

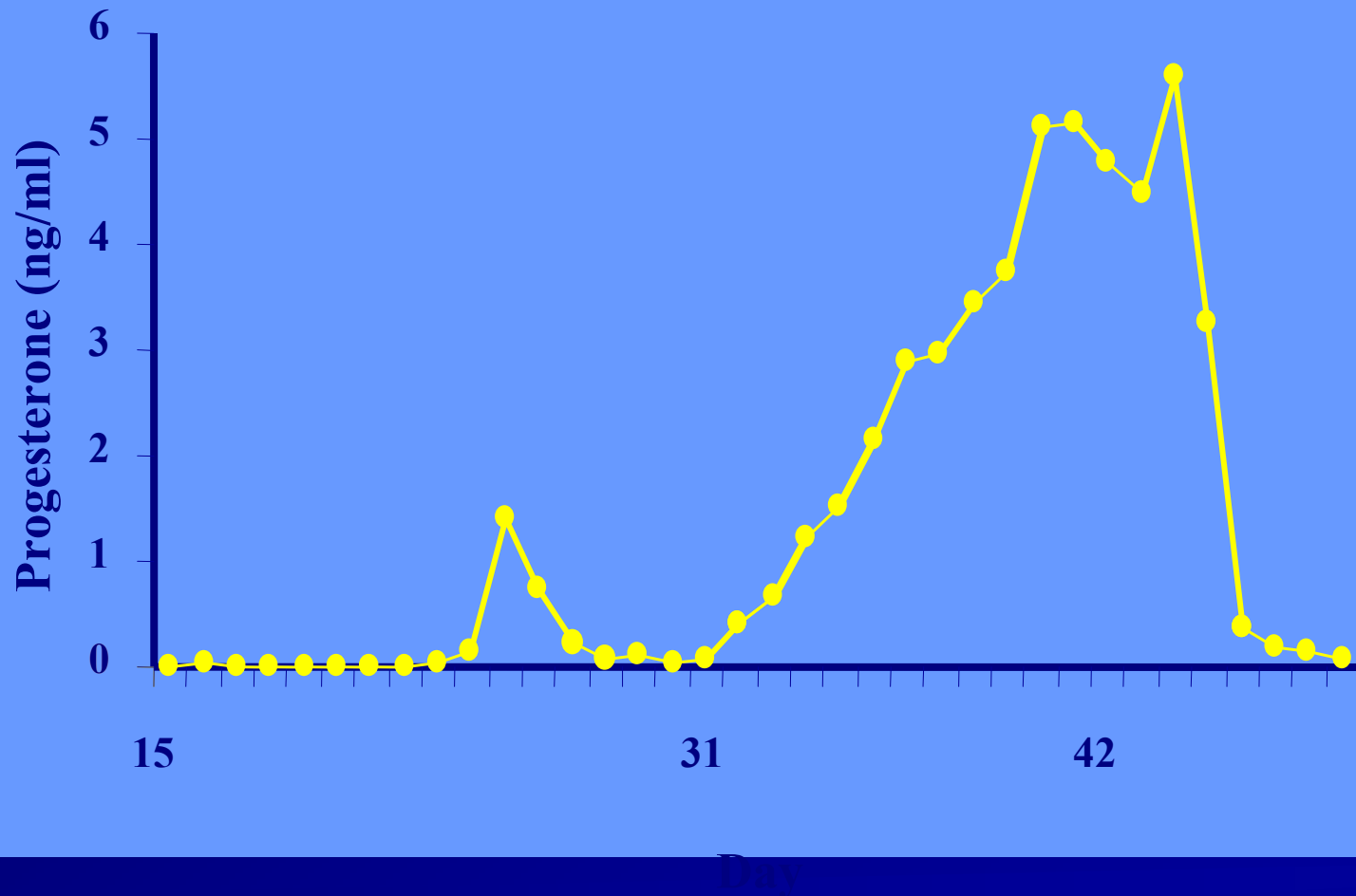


- Maternal recognition of pregnancy – day 15 to 16
- Caution – PGF can induce abortion in pregnant cows

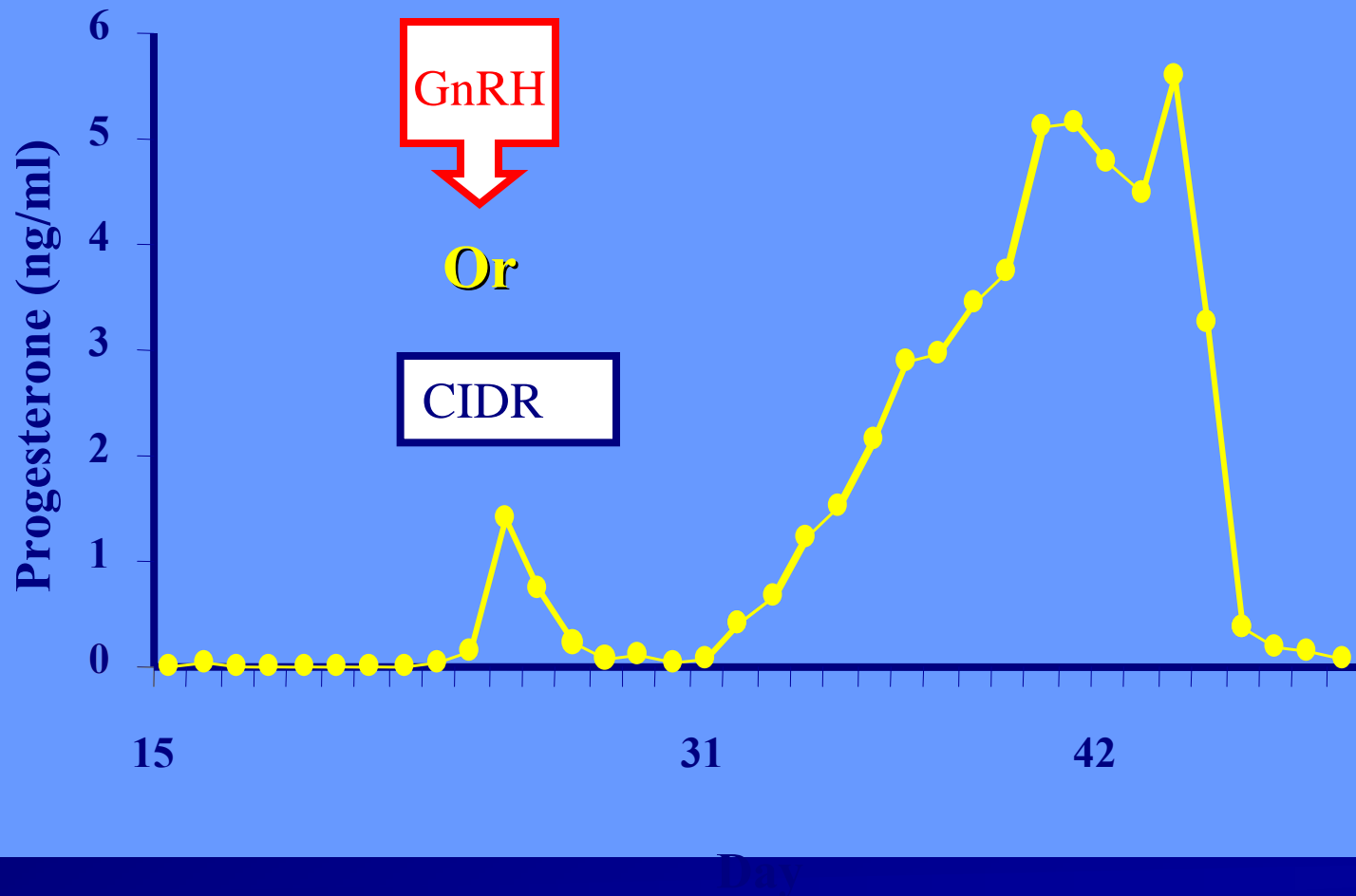
# Physiology of Follicular Waves



# Problem of Anestrus!



# Problem of Anestrus!



# Hormones utilized in Estrus Synchronization Protocols

- Progesterone/Progestins
- Prostaglandin  $F_{2\alpha}$
- GnRH

# Progesterone

## Biological Functions

- Inhibit estrus/ovulation
- Preparation for pregnancy
- Maintenance of pregnancy

# Progestins/Progesterone

## Role in Synchronization

- Inhibit estrus/ovulation
- Induce cyclicity
- Dominant follicle turnover

# Prostaglandin $F_{2\alpha}$

## Biological Function

- Luteal regression in nonpregnant animals

## Role in Synchronization

- Induce premature luteal regression

# **Gonadotropin Releasing Hormone (GnRH)**

## **Biological Function**

- Control secretion of LH
- Induces gonadotropin surge

## **Role in Synchronization**

- Induce ovulation
- Synchronize follicular waves

# Estrus Synchronization Products

## Progestins

- Melengestrol Acetate
- EAZI-BREED CIDR

## Prostaglandin $F_{2\alpha}$

- Lutalyse
- ProstaMate
- In Synch
- Estrumate
- estroPLAN

# Estrus Synchronization Products

## GnRH

- Cystorelin
- Fertagyl
- Factryl
- OvaCyst

# Hormonal management of the luteal phase

- Progestins
- Prostaglandin  $F_{2\alpha}$

# Role of Progestins in Estrus Synchronization

- Synchronization of estrus in
  - beef heifers & cows
  - dairy heifers & cows
- Advances onset of puberty in heifers
- Advances return to estrus after calving in  
COWS

# Progestins

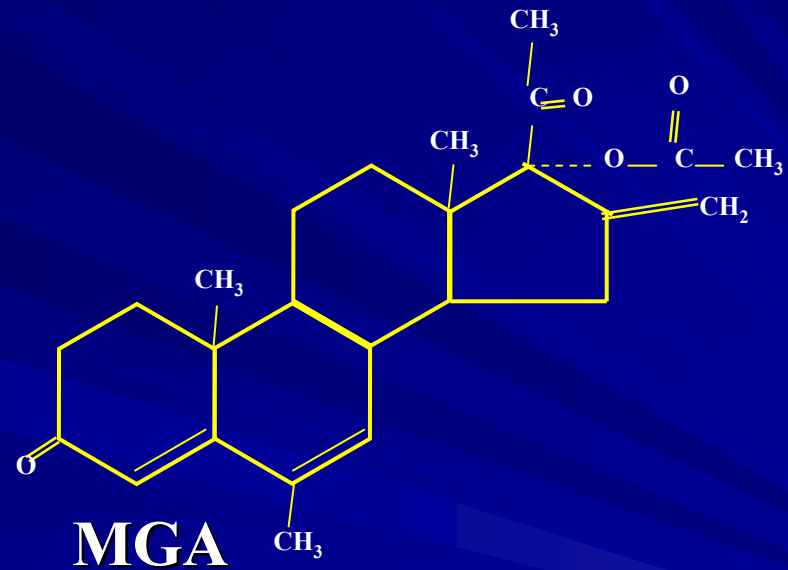
- Melengestrol Acetate - MGA
- Controlled Internal Drug Release  
- CIDR





**Progesterone**

Pregn-4-ene-3, 20-dione

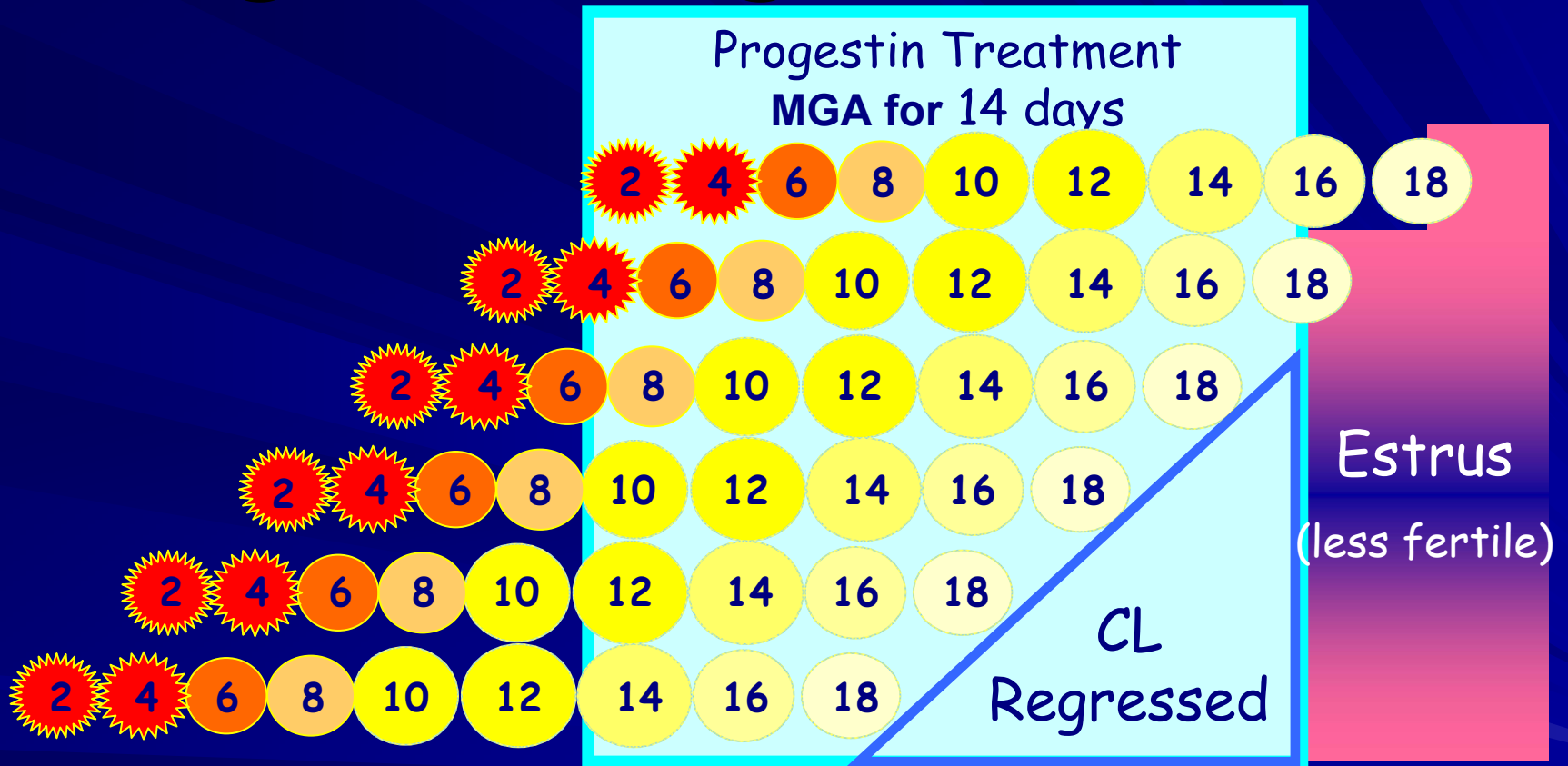


**MGA**

(melengestrol acetate)

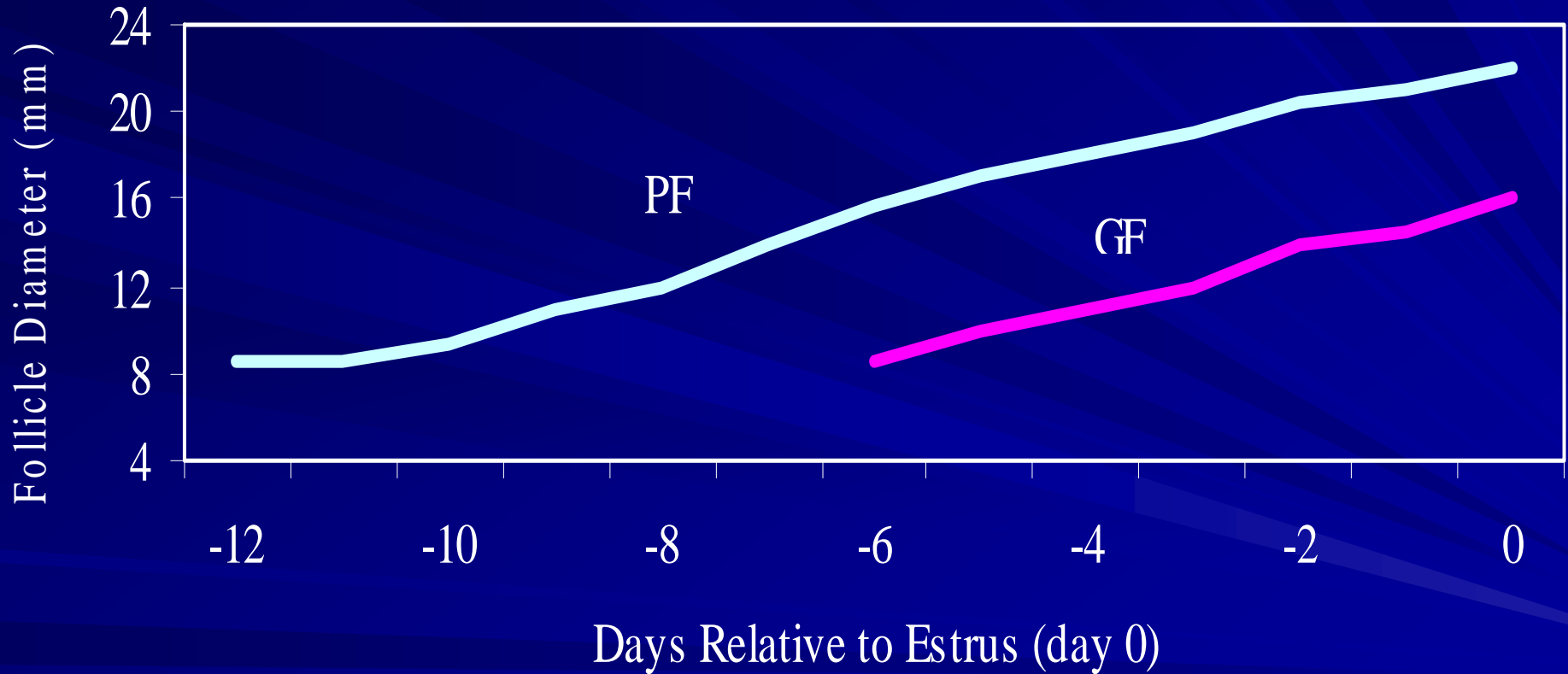
6-methyl-17-alpha-acetoxy-16-methylene-pregn-4, 6-diene-3, 20-dione

# Inhibition of Ovulation Following Long-term Progestin Treatment



# Persistent Follicles

Persistent Follicle (PF) vs. Growing Follicle (GF)

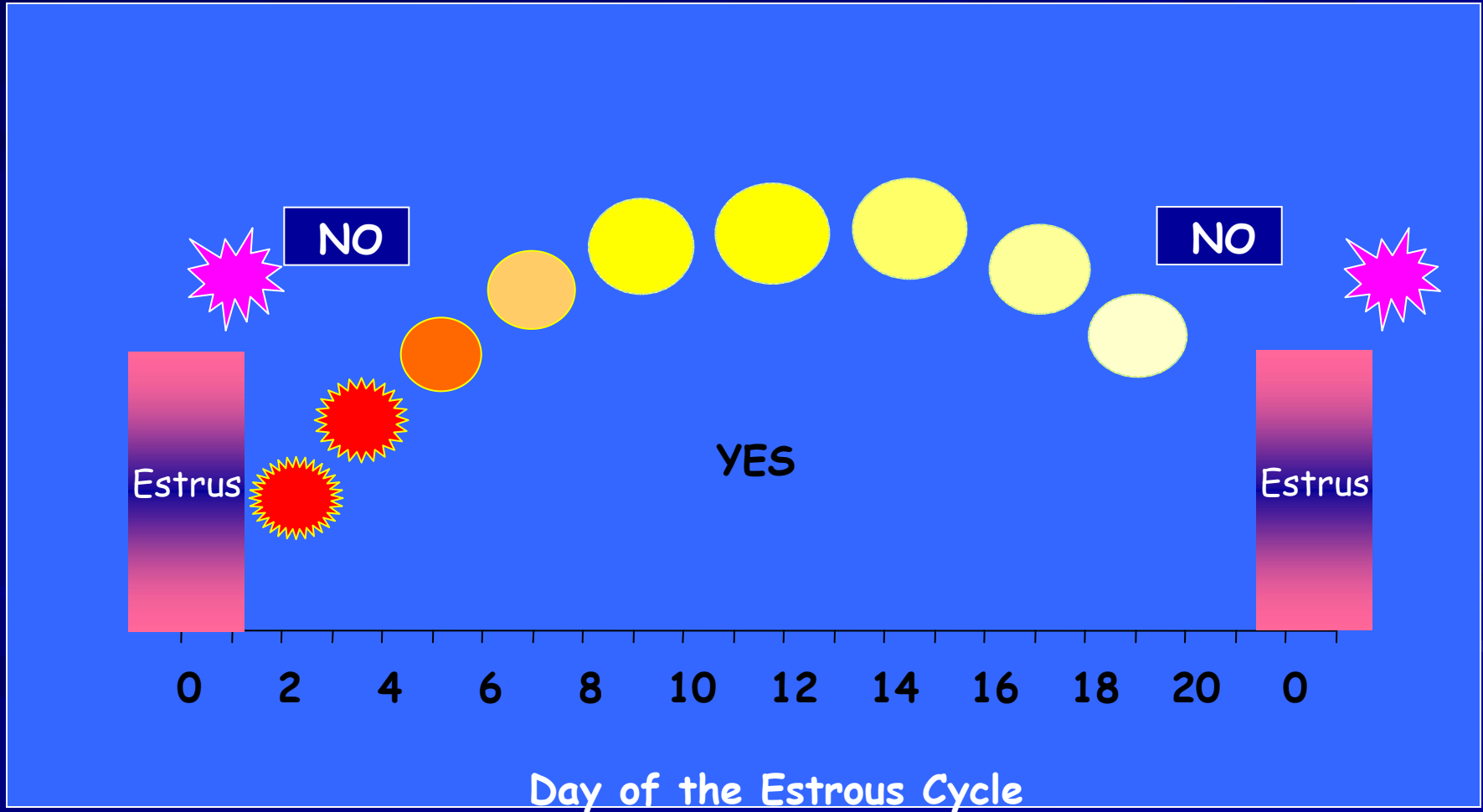


# Prostaglandin $F_{2\alpha}$ (PGF)

(Lutalyse, ProstaMate, Estrumate, In Synch, estroPLAN)

- Causes CL regression
- No effect on noncycling cattle
- No induction of cyclicity  
... No Jump-start
- Effective days 6 to 16 of the estrous cycle (day 0 = estrus)

# PGF<sub>2a</sub> – Effect of stage of the cycle



# Hormonal management of follicular waves

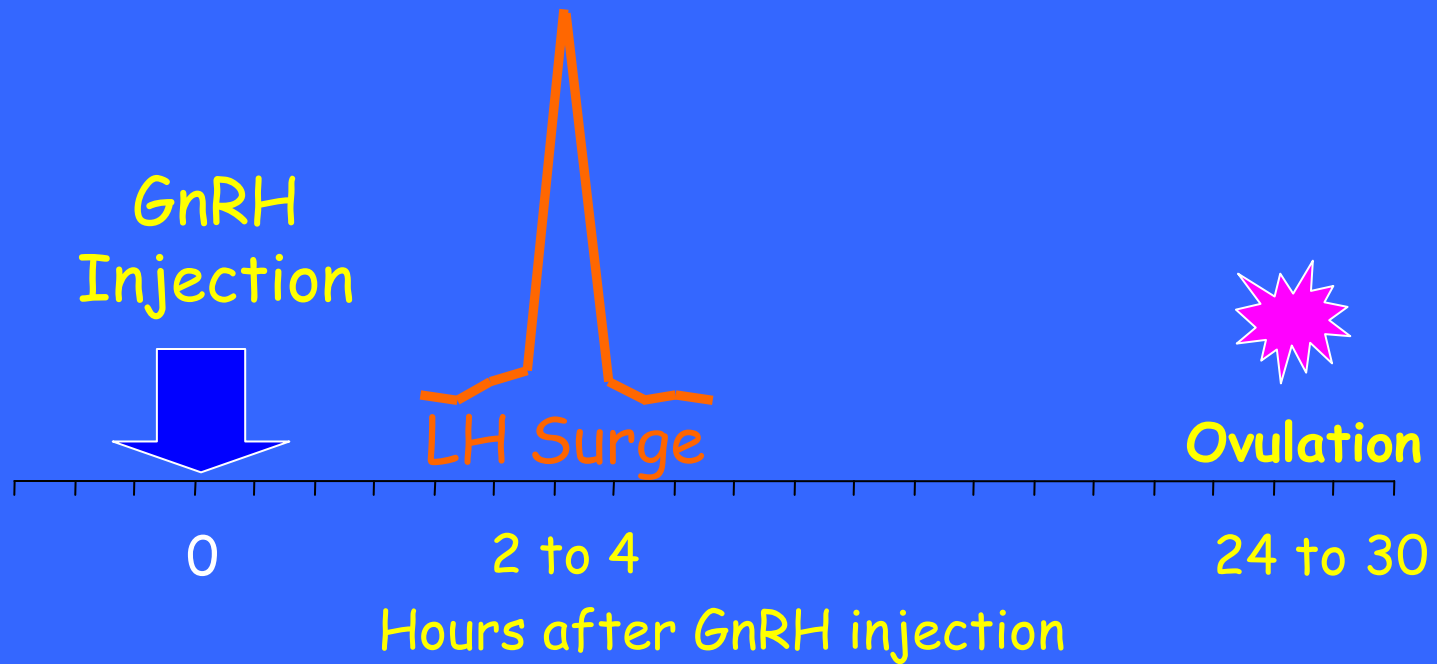
- GnRH – Induces dominant follicle to ovulate
- Estradiol – dominant follicle turnover (↓FSH)
- Progesterone – dominant follicle turnover (↓LH)

# GnRH

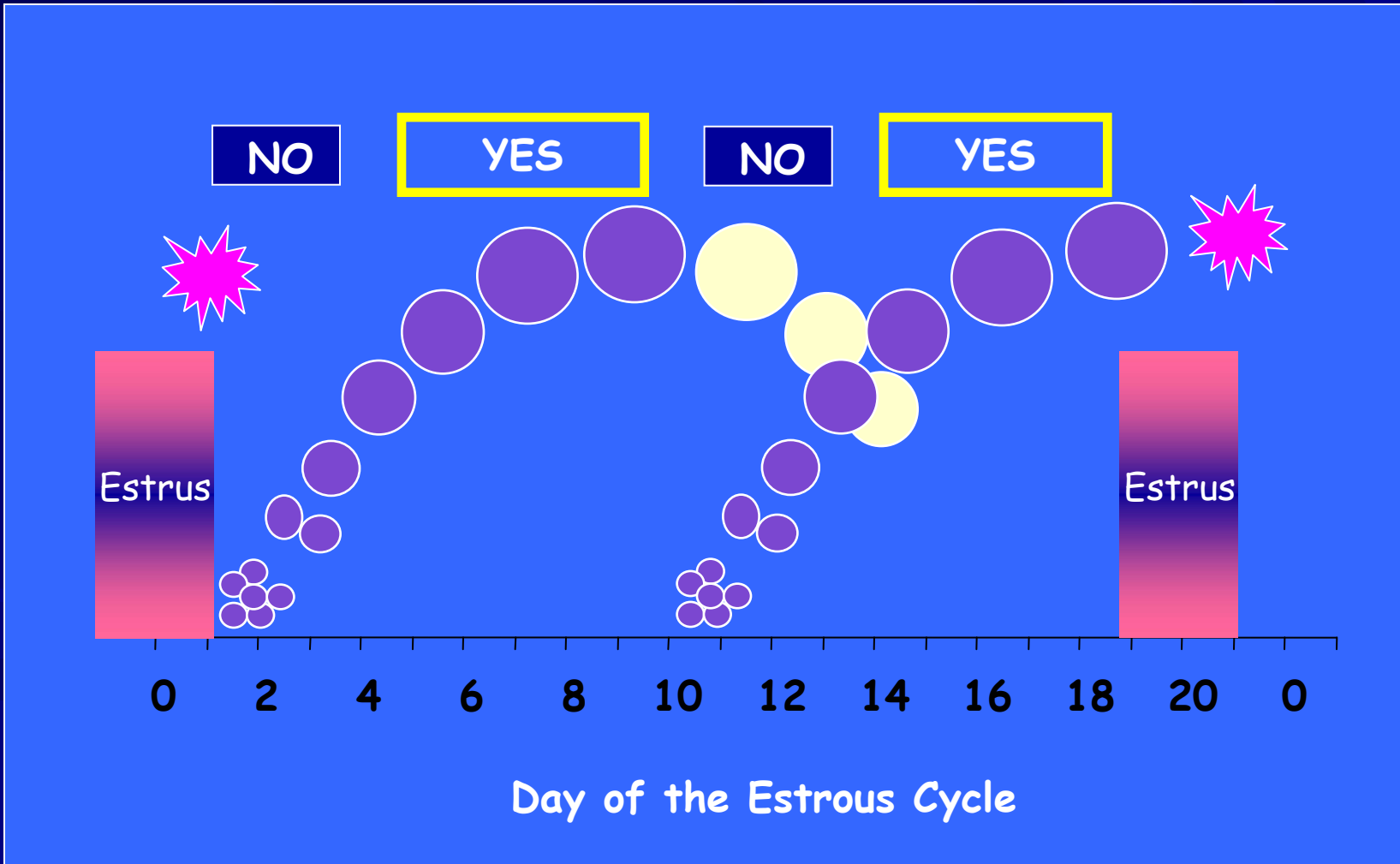
(Cystorelin, Factrel, Fertagyl, Ovacyst)

- Induces ovulation
- Synchronizes follicular waves
- Induces formation of a CL

# GnRH – Induced Surge of LH



# GnRH-Induced Ovulation During a Follicular Wave



**Management considerations  
for selecting heifers and cows  
for synchronization of estrus**

# **Before you start an estrous synch and AI program – Heifers**

What has the pregnancy rate of your heifers been over the past few years?

Have your heifers received growth promoting implants?

Have you selected an appropriate target weight?

# Heifers-contd.

Have your heifers attained 65% of their mature body weight?

What proportion of your heifers have a reproductive tract score of  $\geq 4$ ?

# **Before you start an estrous synch and AI program – Postpartum Cows**

What has the pregnancy rate in your cows been over the past few years?

What is the current length of your breeding season?

# Postpartum Cows – contd.

What proportion of your cows are cycling by the start of the breeding season?

What was the body condition score of your cows at calving?

# Postpartum Cows – contd.

What is the current body condition score of your cows?

How many days postpartum will your cows be when estrus synchronization is initiated?

# Postpartum Cows and Heifers

How much time can you devote to estrus detection?

Considering your handling facilities, how many cows can you breed in an hour?

