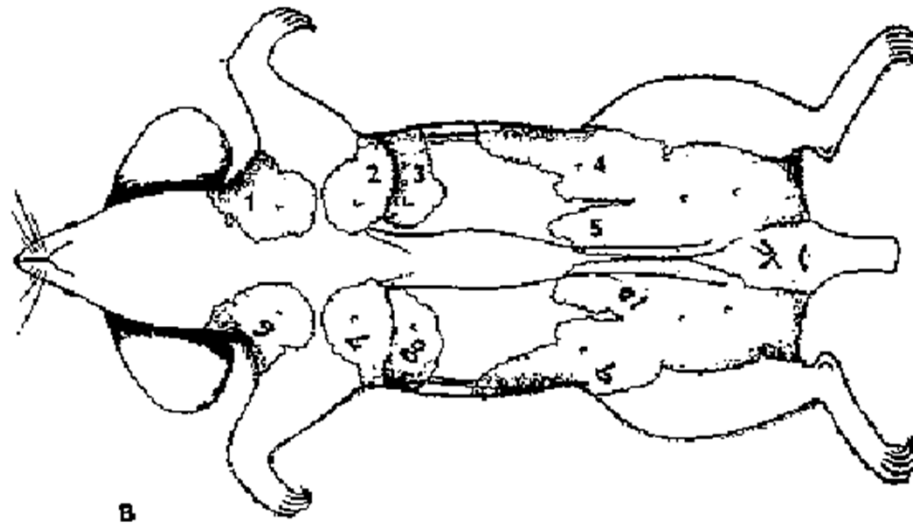
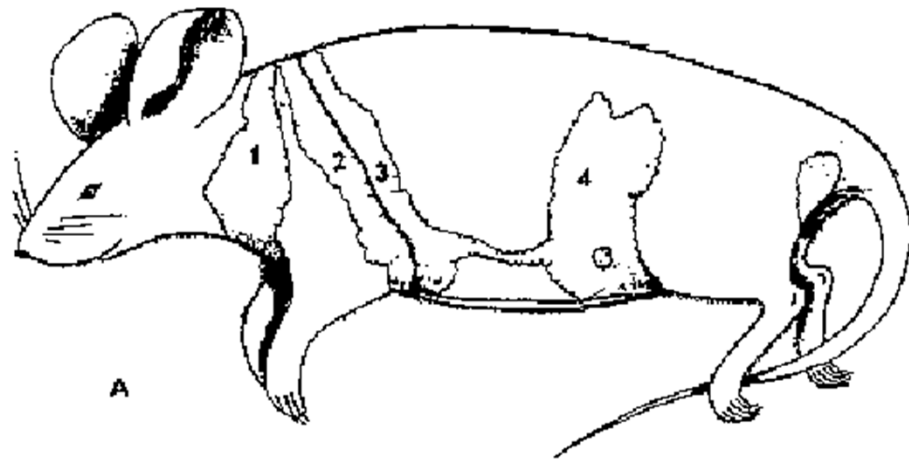


# Lactation

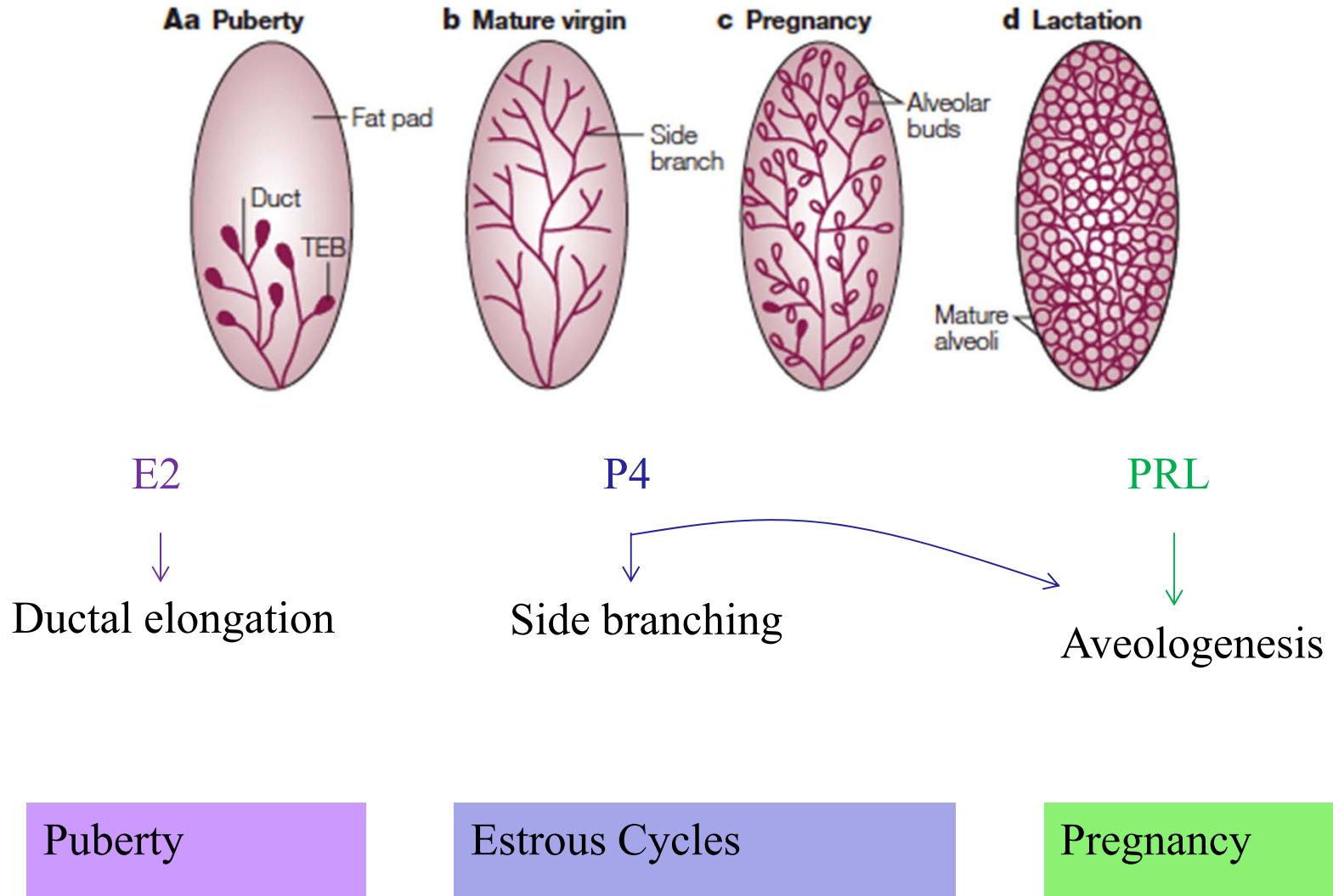


<http://medimoon.com/2012/10/skin-cell-could-be-converted-into-egg-cells/>

# Mouse mammary glands

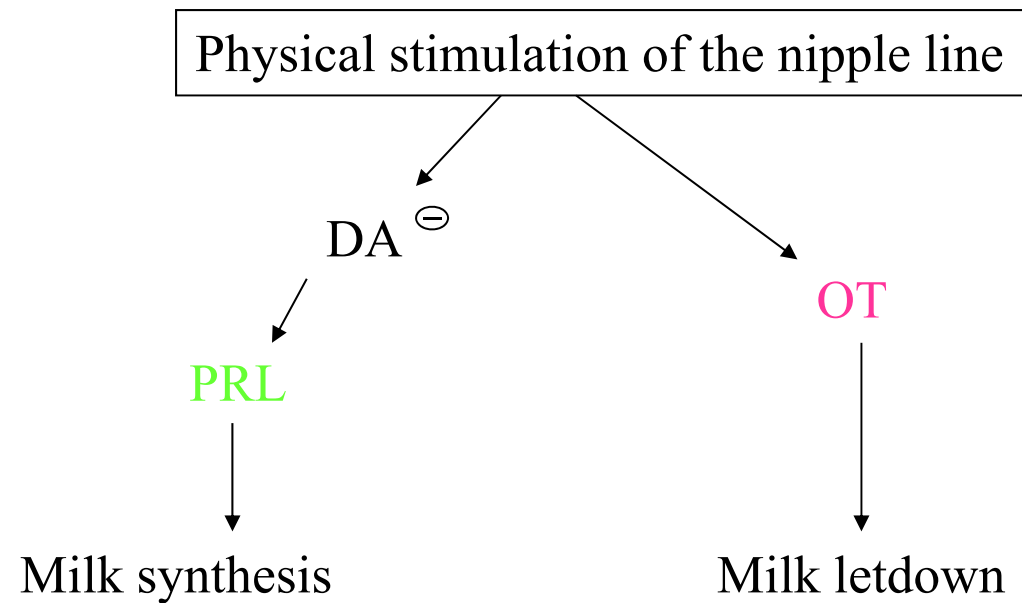


# Mammary development



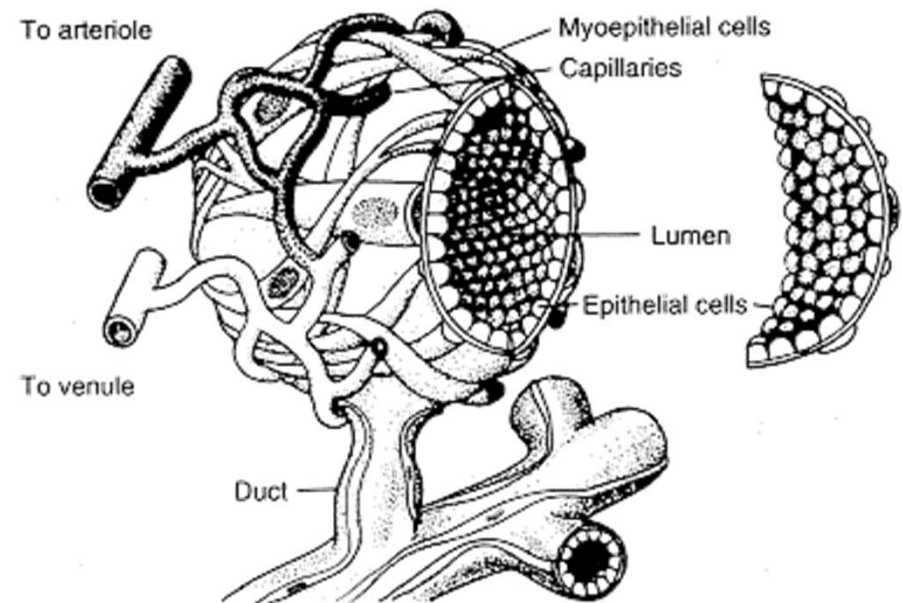
Hennighausen and Robinson. (2005) Nature Reviews

# Mechanism of Lactation



# Mechanism of Lactation

- PRL → Stimulates milk synthesis from the epithelial cells of the lumen
- Oxytocin → Stimulates myoepithelial contraction which facilitates expulsion of milk



# Rabbit Lactation

- Rabbits must pull fur from their nipple line
  - Stimulate lactation
  - Keep kits warm



# Milk Production

- Milk is the sole source of nutrition for the first 2 weeks in rats, mice, hamsters, and rabbits.
  - With the exception of the hamster, they are born without teeth. Hamsters have incisors at birth; mouse and rat incisors erupt ~day 6.
- GP are born with teeth and can nibble solid food starting between 6 hours and 2 days, but need a minimum of 3-4 days of milk to assure survival.

# Milk Composition

<b>Species</b>	<b>Fat (%)</b>	<b>Protein (%)</b>
Cow	3	3
Mouse	12	9
Rat	14	12
Hamster	12	9
GP	4	8
Rabbit	12	10





# Litter size vs. Lactation

- Rodent dams will successfully nurse litters larger than the number of nipples if milk production is high enough.
- Dams who are not producing enough milk may cannibalize pups.
- Some pups may be culled from litters to assure adequate milk supply to remaining pups.

# Suckling Patterns

- Rabbit
  - 5 to 10 minutes per day
  - Dawn or dusk
  - Kits consume about 20% of bwt.



# Suckling Patterns

- Rabbit
  - 5 to 10 minutes per day
  - Dawn or dusk
  - Kits consume about 20% of bwt.
- Rat, mouse, hamster
  - About 18 hours per day
  - Most is comfort suckling
  - Intense suckling occurs for 15 to 20 seconds during a 20 to 30 minute period.



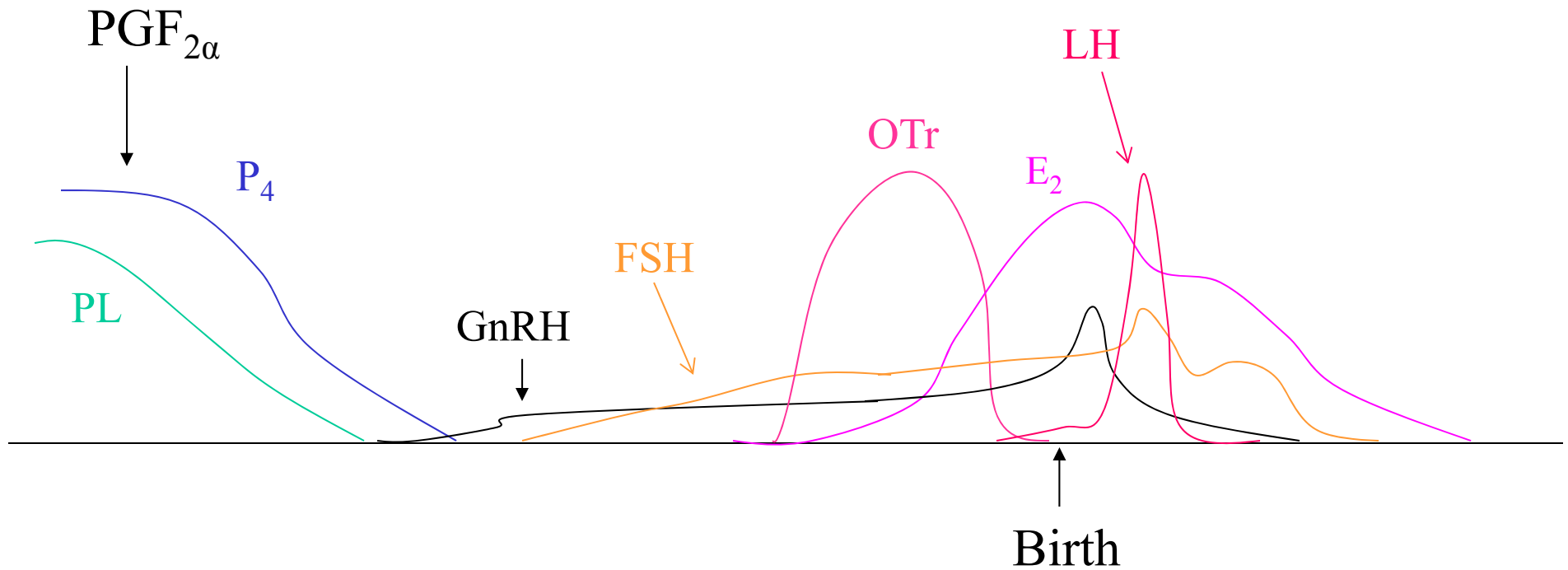
# Size vs milk availability

- Larger litters are likely to produce smaller weanlings since there is less milk available per pup or kit.



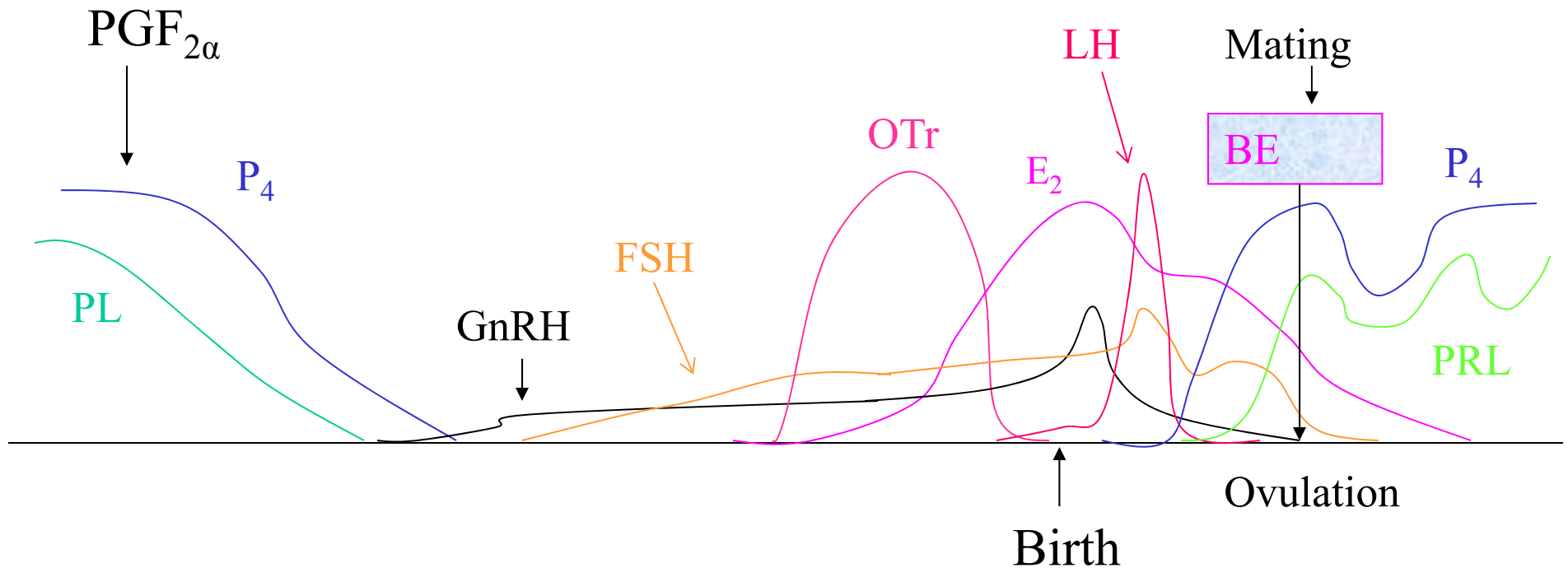
# Postpartum Estrus

- Following parturition, the estrous cycle resumes
  - Drop in  $P_4$  releases GnRH from suppression
  - FSH stimulates follicles to produce  $E_2$
  - $E_2$  reaches the critical level causing the LH surge



# Postpartum Estrus

- Postpartum estrus is a period of behavioral estrus following parturition
  - Behavioral estrus occurs
  - Ovulation occurs
  - Mating can occur within hours of parturition

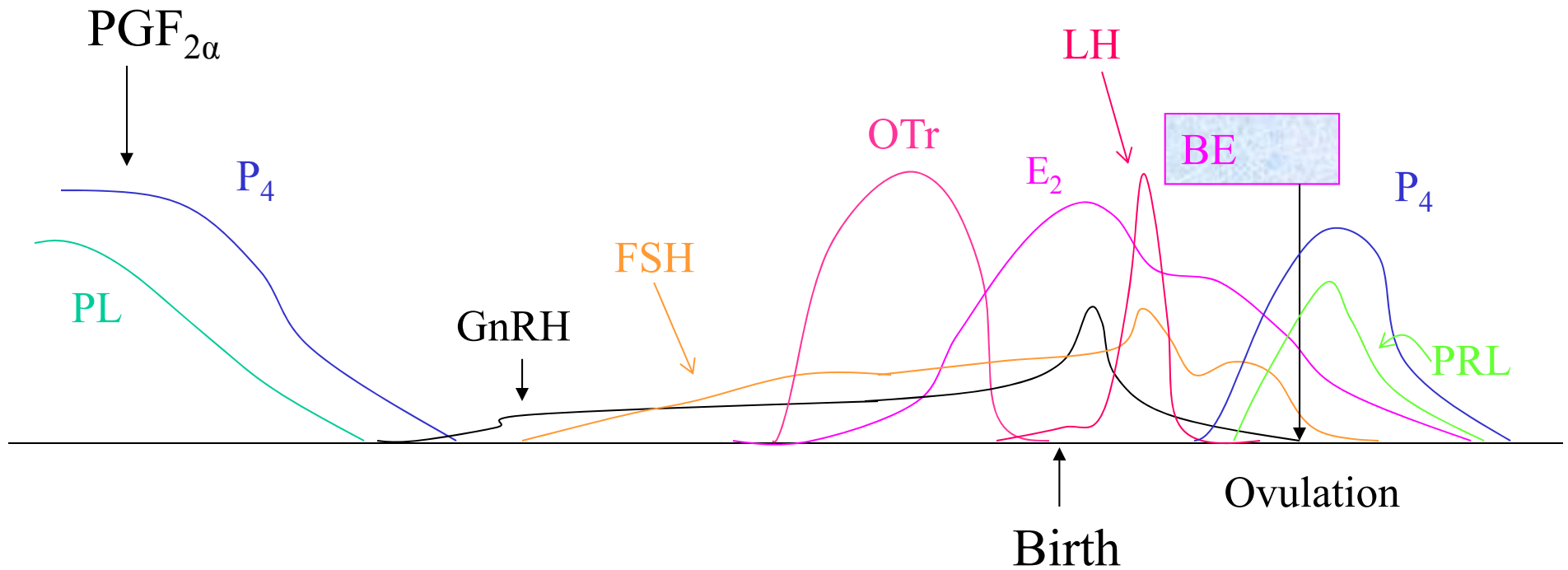


# Post-Partum Estrus

- Mouse: Begins 6-12 hours post-partum
- Rat: Begins 6-12 hours post-partum
- Hamster: Usually anovulatory
- Gerbil: Begins 18-72 hours post-partum
- Guinea pig: Begins 12-15 hours post-partum
- Rabbits: PPE lasts 1 to 2 weeks

# No Lactation & No Pregnancy

- If the female loses her litter and is not pregnant, the cycle will resume

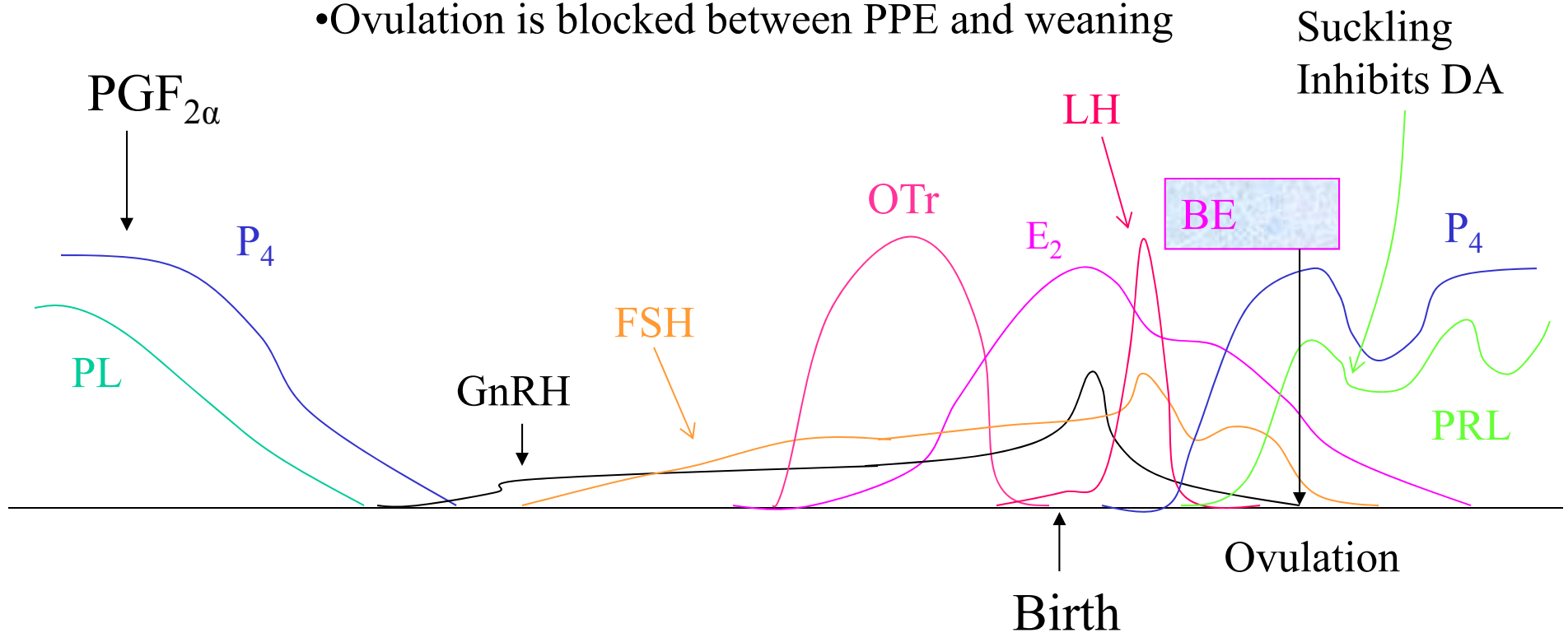




# Lactation Induced Anestrus

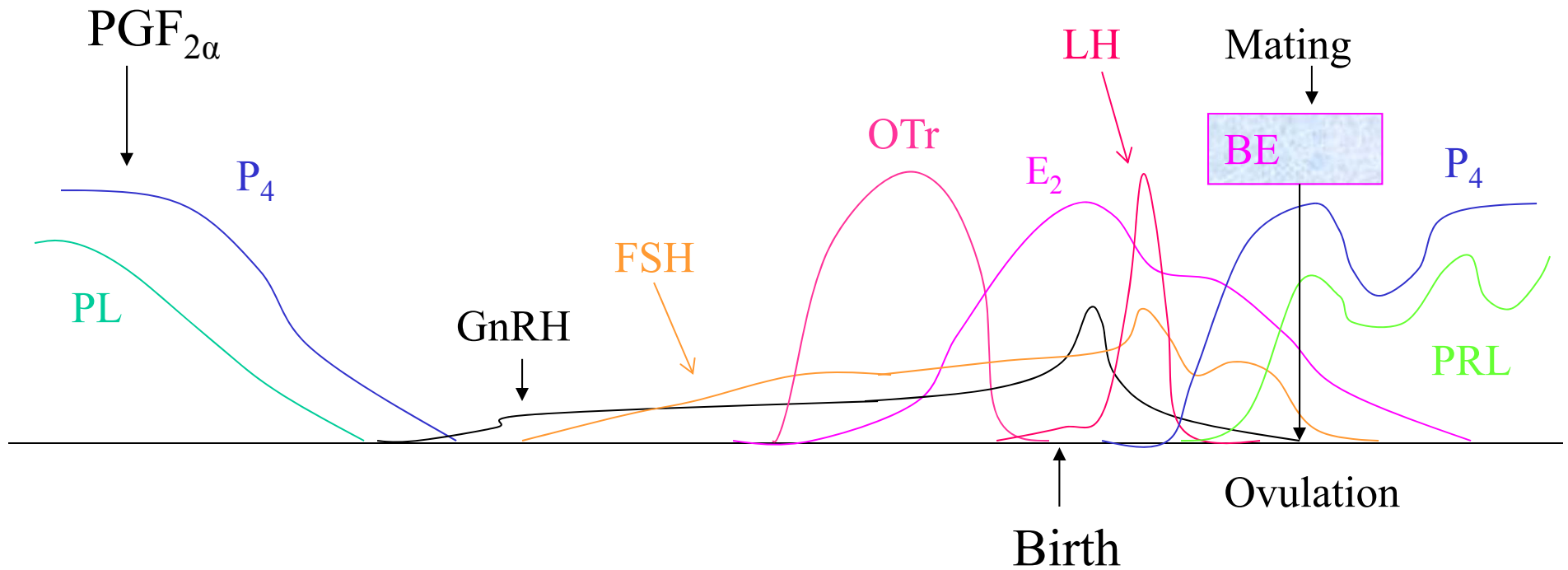
If the female is nursing a litter

- CLs are formed following postpartum estrus ovulation
- Stimulation of the nipple line will inhibit DA
- PRL will maintain the CL
- P<sub>4</sub> from the CL blocks GnRH
- Ovulation is blocked between PPE and weaning



# Pregnant and Lactating

- If the mating is fertile, the female will maintain the pregnancy and nurse the litter at the same time.



# Double Burden

- Mating during postpartum estrus puts a double burden on females
  - Rats and mice
    - Embryonic diapause (delayed implantation)
  - Rabbits
    - Increase embryo mortality proportional to nursing young.
  - Guinea pigs
    - No need for adjustment; precocious young do not put as heavy a burden on the sow.

# Post-Partum Patterns

- Mouse: Begins 6-12 hours post-partum; embryonic diapause
- Rat: Begins 6-12 hours post-partum; embryonic diapause
- Hamster: Usually anovulatory
- Gerbil: Begins 18-72 hours post-partum; embryonic diapause
- Guinea pig: Begins 12-15 hours post-partum but sows do not exhibit anestrus.
- Rabbits: Do not exhibit complete anestrus following parturition, but their receptivity may decrease as lactation progresses.