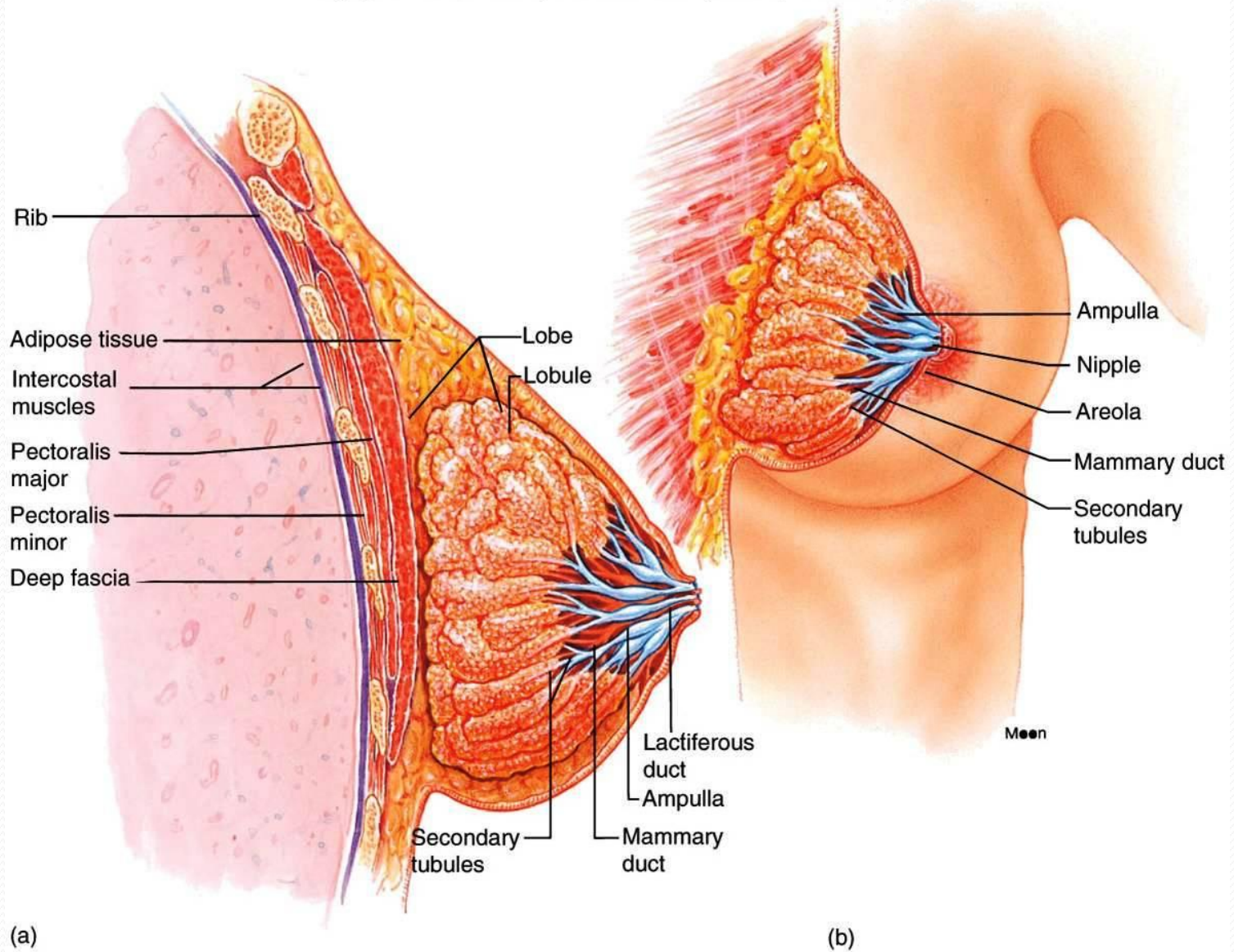


# Hormones affecting the breast

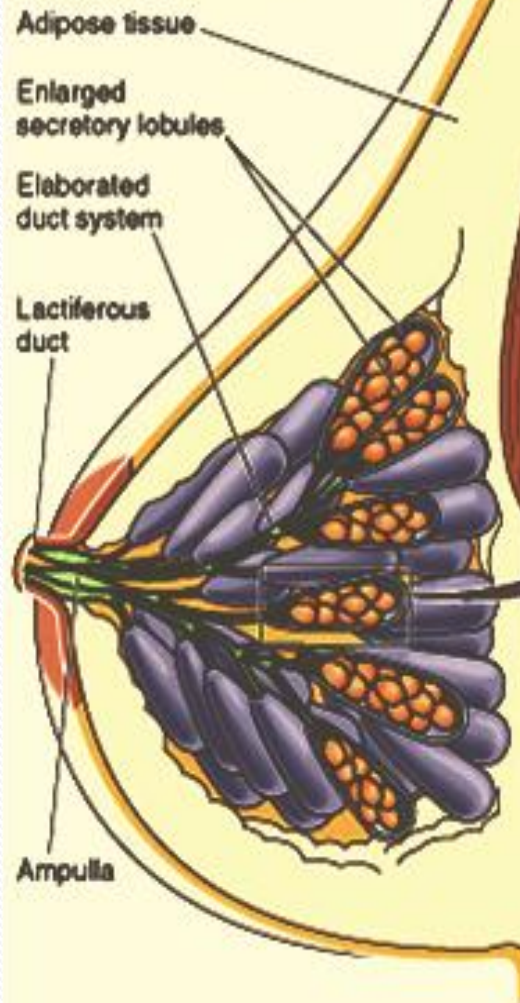
Dr. Hana Alzamil

# Objectives

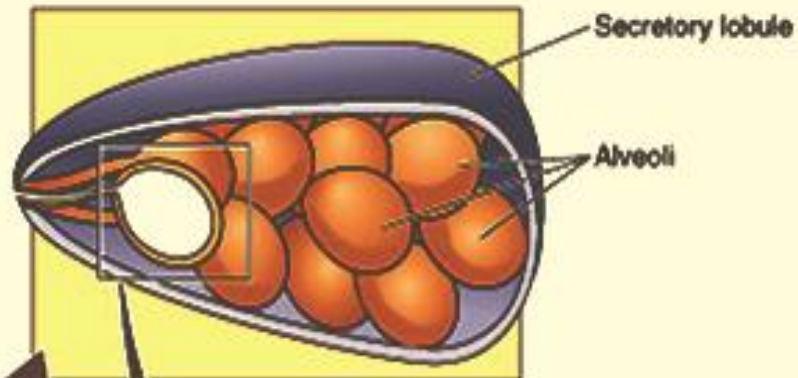
- Hormonal requirement for breast development
- Hormones involved in the process of lactation and their physiological action
- Physiological basis of suckling reflex and its role in lactation



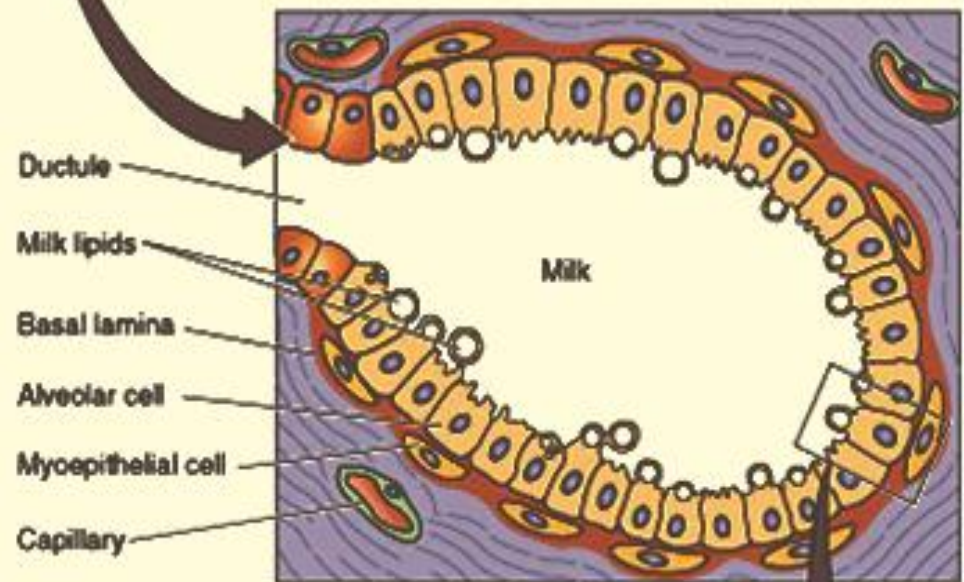
### A LACTATING BREAST



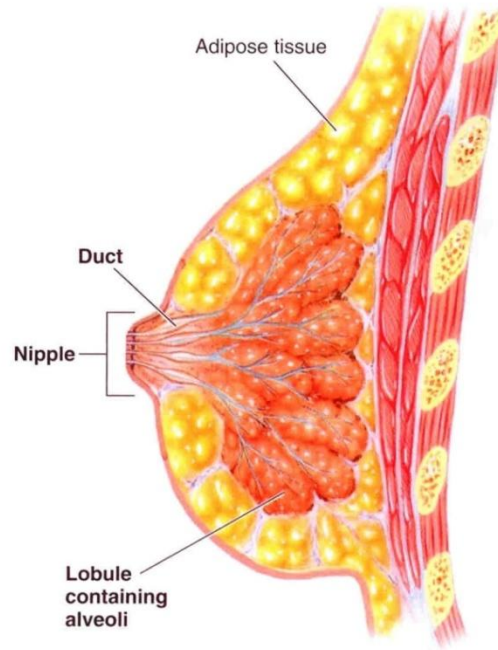
### B LOBULE



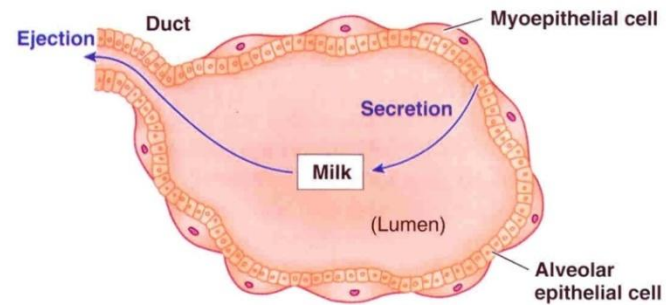
### C ALVEOLUS







(a) Internal structure of mammary gland, lateral view

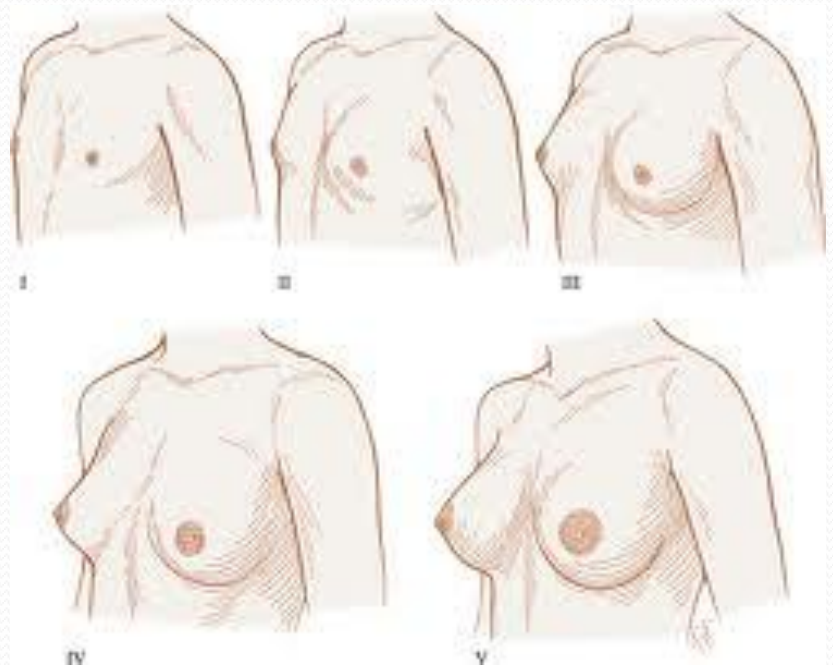
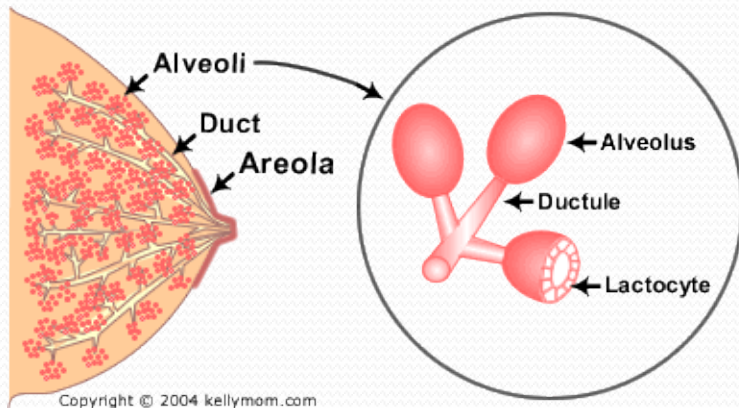


(b) Alveolus within mammary gland

● **FIGURE 20-34 Mammary gland anatomy.** The alveolar epithelial cells secrete milk into the lumen. Contraction of the surrounding myoepithelial cells ejects the secreted milk out through the duct.

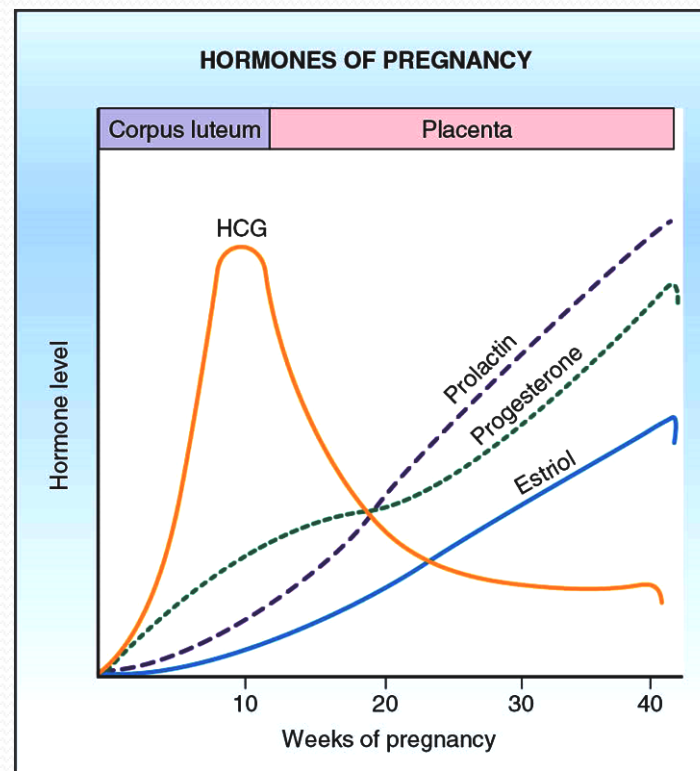
# Breast development

- During puberty
  - Estrogen stimulate proliferation of ducts and deposition of fat
  - Progesterone stimulate development of lobules



# Breast development

- During pregnancy
  - Complete development of glandular tissue



# Breast development

- Endocrine system plays a major role in synchronizing development and function of mammary gland with reproduction
- Three categories of hormones:
  - Reproductive hormones (endocrine)
    - Estrogen, progesterone, prolactin, oxytocin and PL
  - Metabolic hormones (endocrine)
    - GH, corticosteroids, thyroxin, PTH and insulin
  - Mammary hormones (autocrine)
    - GH, prolactin, PTHrP and leptin



# Breast development

- Reproductive hormones (direct effect)
  - Estrogen (placenta)
    - Growth & branching of ductal system (with GH)
    - Fat deposition in the stroma
  - Progesterone (placenta)
    - Growth of lobule-alveolar system (budding of alveoli and secretory changes in epithelial cells )
- Although estrogen and progesterone are essential for physical development of the breasts, they inhibit actual secretion of milk

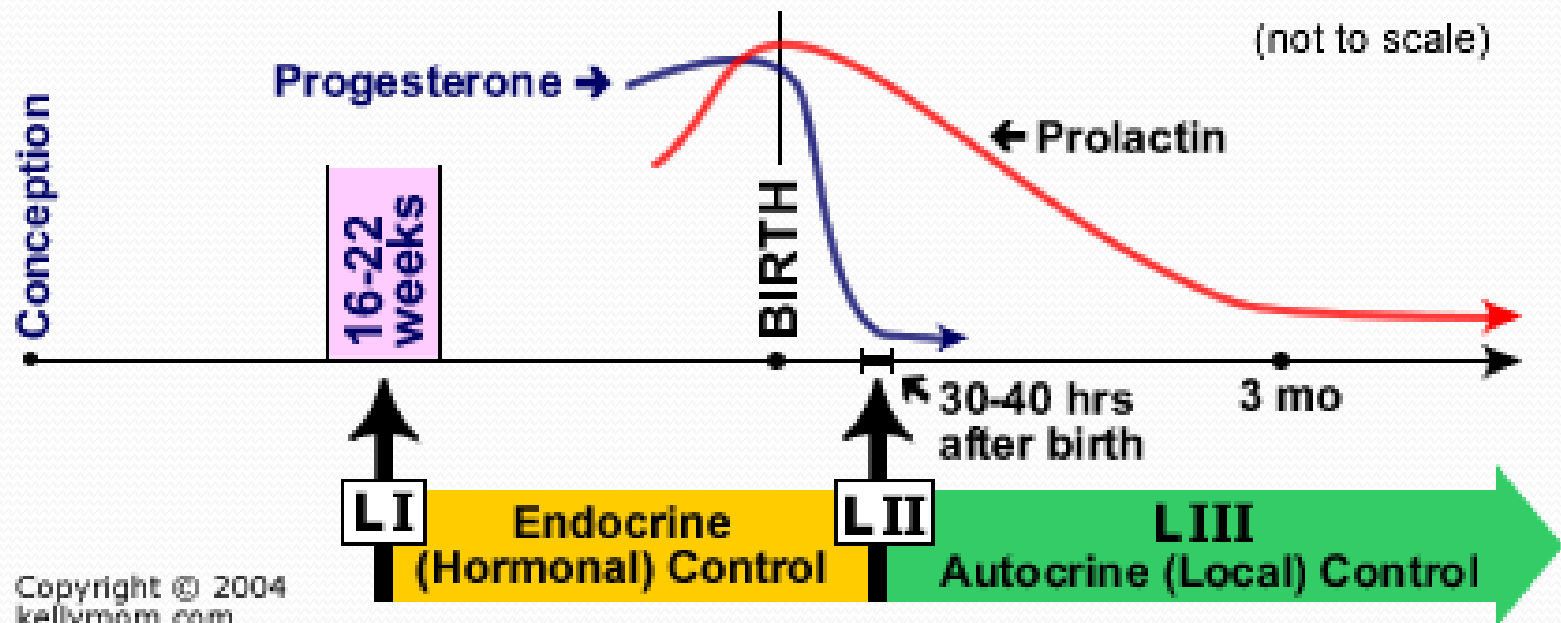
# Breast development

- Prolactin (anterior pituitary)
  - Its level increases during pregnancy (10-20 times)
  - Its main function is milk production
  - Sudden drop in E & P after delivery allows milk production
  - It is controlled mainly by hypothalamic hormone
    - **PIH (Dopamine)**

# Hormonal regulation of lactogenesis

- Lactogenesis: cellular changes by which mammary epithelial cells are converted from a nonsecretory state to a secretory state: 2 stages
- Lactogenesis 1: starts in midpregnancy and characterized by expression of many genes involved in synthesis of milk components (increases in uptake transport systems for amino acids, glucose, and calcium required for milk synthesis).
  - Hormones involved:
    1. Progesterone (suppresses milk secretion)
    2. Prolactin and/or placental lactogen
    3. Growth hormone
    4. Glucocorticoids

# Stages of lactogenesis



# Hormonal regulation of lactogenesis

- Lactogenesis 2:

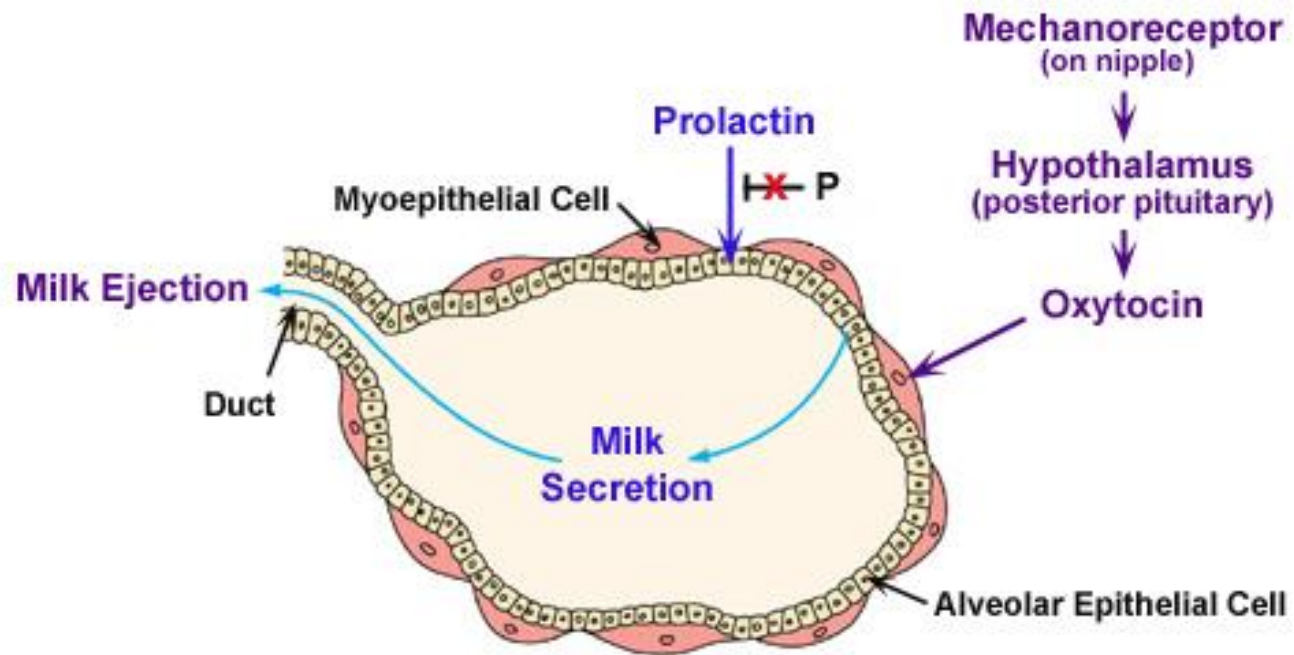
around parturition withdrawal of **progesterone** + high level of **prolactin** leads to:

- Further increase in expression of milk protein genes
- Movement of cytoplasmic lipid droplets and casein into alveolar lumina
- Transfer of immunoglobulins
- Secretion of colostrum followed by milk

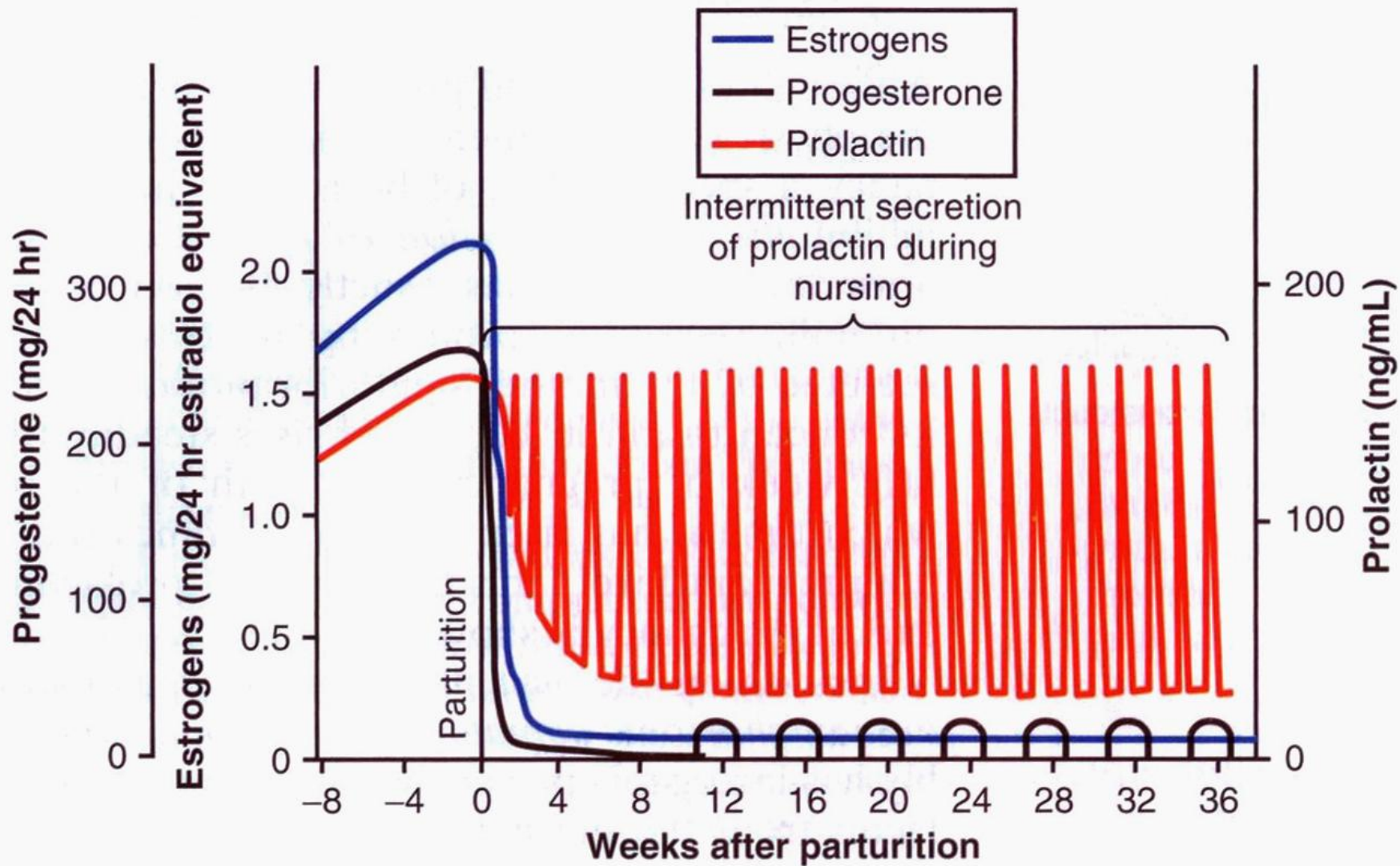


# Hormonal regulation of lactogenesis

- Lactogenesis 2:
  - Suckling stimulates further increase in expression of genes involved in milk secretion with expansion of alveolar epithelium
  - Lactation is maintained by removal of milk
  - 2 hormones involved
    - Prolactin (milk production)
    - Oxytocin (milk let-down)



**Alveolus of Mammary Gland**



# Hormonal regulation of lactogenesis

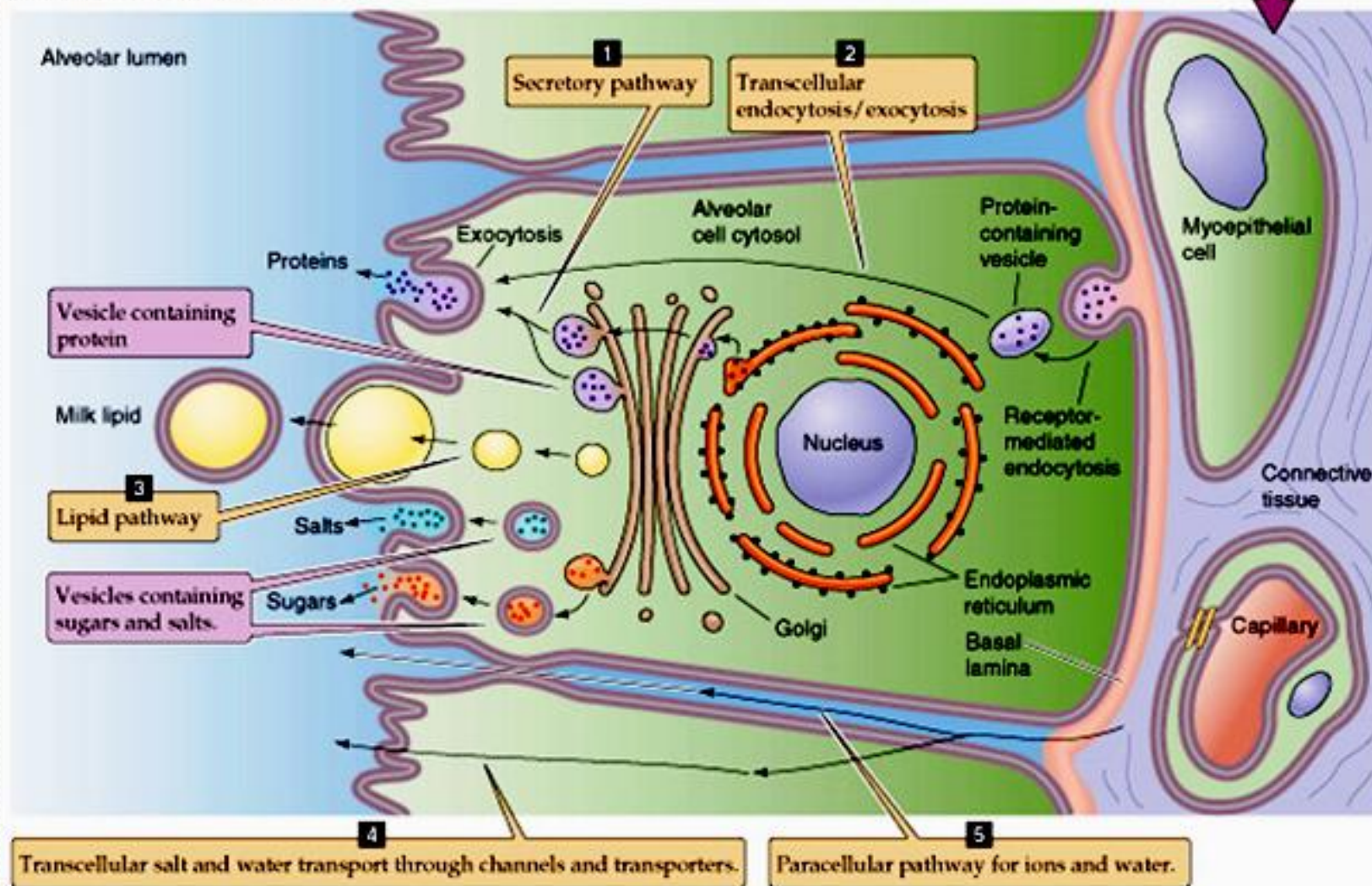
- Metabolic hormones (direct effect)
  - GH
    - Can be produced locally
    - Its secretion is stimulated by progesterone
    - Increases production of IGF-1 by the liver
    - Mediate cell survival and ductal growth
  - Corticosteroids
    - Increases during pregnancy (fivefold)
    - Involved in breast development (permissive action on milk protein synthesis)

# Hormonal regulation of lactogenesis

- Thyroxin
  - Essential for milk production
  - Thyroxin & TSH level decreases during lactation
  - TRH increases leading to stimulation of PRL (nasal administration to treat inadequate lactation )
- Insulin
  - Transfer of glucose into cells
  - Shunt of nutrients from storage depots to milk synthesis



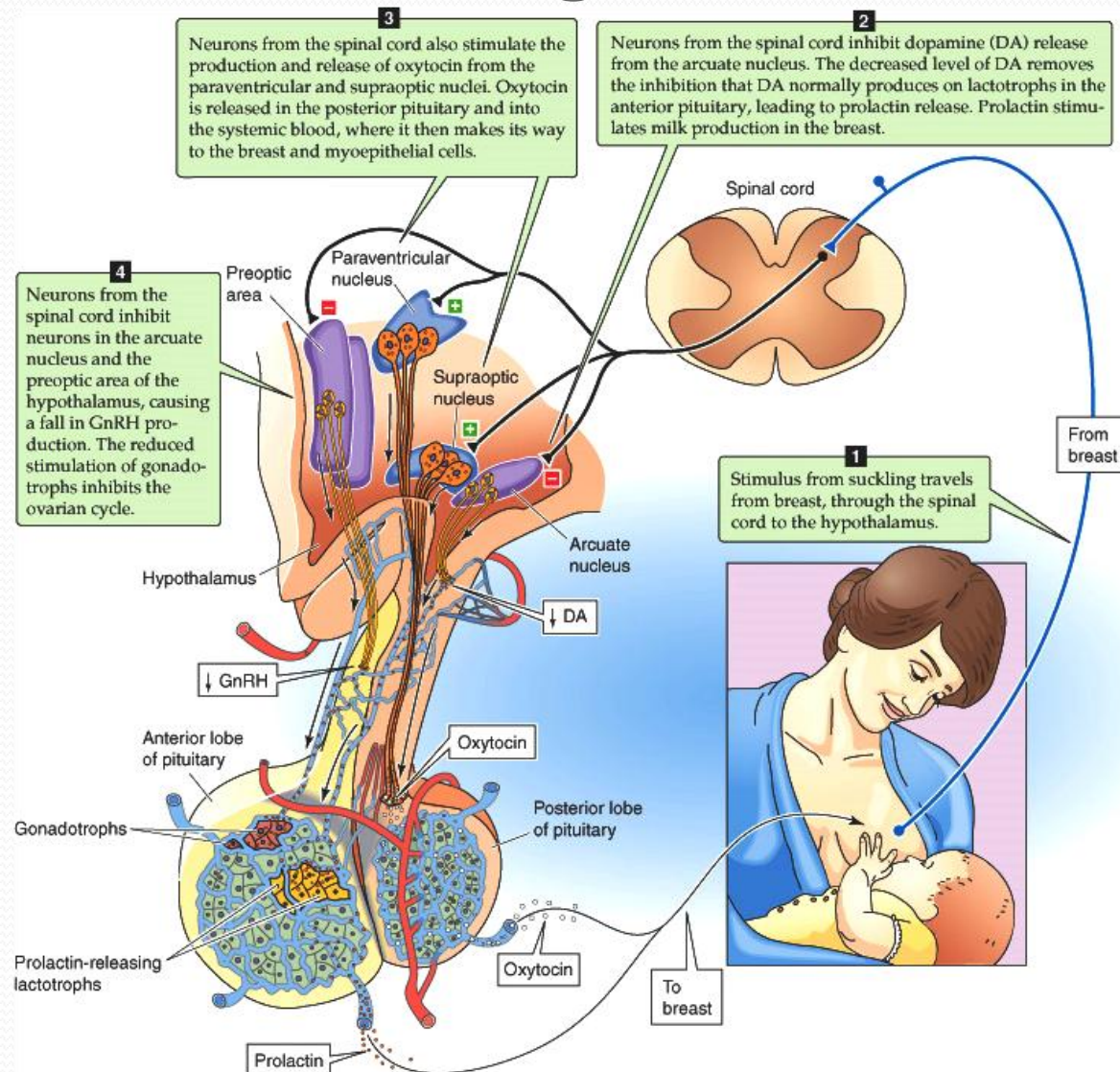
# D SECRETORY EPITHELIAL CELL



# Hormonal regulation of lactogenesis

- Mammary hormones
  - GH
    - Progesterone stimulates its secretion
  - Leptin
    - Increases during pregnancy (increase adipose tissue)
    - Decreases with lactation
  - PTHrP
    - Increases during lactation
    - Mobilizes bone calcium
    - Increase in alkaline phosphatase

# Suckling reflex





# Suckling reflex

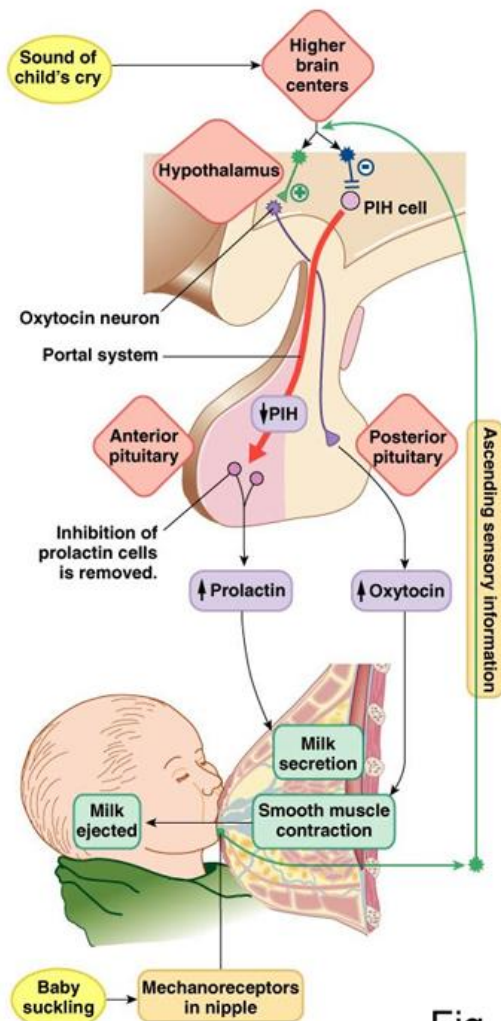


Fig. 26-23

- Milk production is a

"use it or lose it" process.

The more often and effectively the baby nurses, the more milk will be produced

- Milk production <100 ml/day in day 1 postpartum
- Milk production by day 3 reaches 500 ml/day
- Milk composition changes dramatically( $\downarrow \text{Na}^{+2}$  &  $\text{Cl}^{-}$ ) due to closure of tight junctions that block paracellular pathway



